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COVER PHOTO

Fireball from history's first atomic artillery shell fired from Army's 280 mm gun, at Frenchman's Flats, Nevada, on May 25, 1953. This remarkably vivid color-photograph recently became available for publication.

The Armed Forces Chemical Journal is the official publication of the Armed Forces Chemical Association. The fact that an article appears in its columns does not indicate the approval of the views expressed in it by any group or any individual other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors.

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A. F. C. A. CONSTITUTION

President Nathaniel S. Prime announces that in mail balloting conducted since the annual meeting last May, the Directors of the Association voted to amend the Constitution by revising Article II—Objectives, so as to read as follows:

ARTICLE II—Objectives

The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare.

The objectives of this Association are, therefore, (1) to build up an organization capable of supporting and serving the Chemical Corps in the chemical, bacteriological, radiological, and other scientific and engineering activities under its cognizance and to support and further the progress of all the Armed Services in the fields of science falling within the competence of the Association, (2) to disseminate among its members a knowledge and appreciation of the interests of the Armed Services and other defense agencies in chemistry, allied sciences and related applied sciences, (3) to establish the support of civilian agencies and individuals in promoting new developments in chemistry, in the allied sciences and in engineering applications designed to increase the efficiency and effectiveness of the services in chemical warfare and other strategic and tactical applications of the sciences and technologies falling within the scope of the Association, (4) to foster a spirit of understanding, cooperation and good will among its members, the Armed Services, and interested civilian organizations, and (5) to perpetuate the friendships, memories and traditions growing out of service in the defence of the United States. The members of the Association and its constituent local chapters are mutually pledged to the furtherance and promotion of these objectives.

THE JOURNAL'S STAFF

With a view to making the JOURNAL of greater interest and service to the Association a number of contributing editors has been added to the editorial staff: Dr. Robert L. Fox, Dr. D. Bruce Dill, Mr. Daniel F. Reisenweber and Mr. John A. Kley, all of the Chemical Corps of the Army, and Mr. Irving Poretz of the Materiel Command, U. S. Air Force.

The Editor desires here to give public expression to the welcome—already extended privately—to these new helpers who, like our associate editors, serve strictly "for the good of the cause" without any monetary compensation. It is planned in future issues, to introduce these contributing editors more adequately than time permits here. Each of them is well qualified in one or more fields of Association concern to write himself or promote and develop interesting articles.

We are happy to have for the year ahead—and we hope for many more to follow—the continued assistance of Col. L. Wilson Greene as associate editor.

It is with regret that there have now been dropped from the JOURNAL'S "masthead" the names of Lt. Col. H. B. Rodier as editorial consultant and Major John F. Carroll as associate editor. Colonel Rodier, long the editor of the JOURNAL, retired from that post last year, has now taken up residence in Florida and seldom comes to Washington. Major Carroll notes that he now is away much of the time from his New York office. As needs may arise in the future we shall seek these old friends out and call upon them.

—EDITOR

HEADS NEW YORK CHAPTER



Simon Askin, president of Heyden Chemical Corporation, was elected president of the New York Chapter, Armed Forces Chemical Association, at a luncheon meeting in June at the Hotel Belmont Plaza. Mr. Askin succeeds Major General William N. Porter, U.S.A. retired, chairman of the board of Chemical Construction Corporation.

Carlton Bates, executive vice-president of the Solvay Process Division of Allied Chemical & Dye Corporation was elected first vice-president; Robert Milano, president of Millmaster Chemical Corporation, re-elected second vice-president and Walter E. Spicer, Manager of the Quality Control Department of the Lambert Pharmacal Company, re-elected secretary-treasurer.

Directors include Willard Jacobs, chairman of the board of Niagara Alkali Corporation, S. M. Cummings, president of Pylam Products Corporation, Edwin C. Kenton, vice-president of Evans Chemetics, Inc., General Porter, Mr. Askin, Mr. Bates, Mr. Milano and Mr. Spicer.

DR. P. K. FROLICH TO CHEMICAL CORPS

As the Journal went to press, information was received of the appointment of Dr. P. K. Frolich, a vice president of the chemical firm of Merck and Co., Inc., Rahway, New Jersey, to the Chemical Corps' top civilian scientific post. The announcement stated Major General William M. Creasy, Chief Chemical Officer, planned to have Dr. Frolich serve in a dual role—Deputy Chief Chemical Officer for Scientific Activities, and Chief Scientist for the Corps. Dr. Frolich is expected to assume these duties about December 1.

GENERAL OFFICER PROMOTIONS



CHARLES ERNEST LOUCKS



JOHN ROBERT BURNS



MARSHALL STUBBS

Three promotions of much importance in the organization of the Chemical Corps were recently announced. Charles E. Loucks, Deputy Chief Chemical Officer, was increased in grade from Brigadier General to Major General. Colonels John R. Burns, Chief of the Training Command, and Marshall Stubbs, Chief of the Materiel Command, were made Brigadier Generals. Both of the latter two positions were previously filled by Brigadier Generals, but heretofore the Corps has never had but one general officer (the Chief) with more than one star.

Charles Ernest Loucks

General Loucks has been Deputy Chief since July 1951. He is one of the very few officers of the Corps on active duty whose service dates from World War I. Born in California, June 29, 1895, he attended Leland Stanford University and, before graduation, received a commission in the Coast Artillery, entering on active duty May 3, 1917. After service on the west coast and in the Philippines, he obtained a Bachelor's Degree, came east for duty and in 1925 transferred to the Chemical Warfare Service. As a young officer he participated in the National Rifle and Pistol Matches, receiving the rating of Distinguished Rifleman.

From 1929 to 1931 he attended Massachusetts Institute of Technology and obtained a Master's Degree in Chemical Engineering. Following a number of technical assignments including that of Technical Director at Edgewood Arsenal, he attended the Army Industrial College. In 1940 and 1941 he served in Paris and London as assistant military attaché and later in Washington as executive in the Chief's office. In 1942 he took command of the new Rocky Mountain Arsenal at Denver, returning to Washington in 1944 for duty as head of the Industrial Division in the Chief's office. He spent the latter part of 1945 in Japan as Theater Chemical Officer. Subsequent assignments until he assumed his present post included duty as Chief of the Research and Engineering Division, Chemical Corps, Washington; Chief of the Chemical Division, European Command, Heidelberg, Germany and Commanding General of the Army Chemical Center, Md.

Gen. Loucks has been awarded the Distinguished Service Medal, the Legion of Merit, and the Army Commendation Ribbon.

John Robert Burns

General Burns has commanded the Chemical Corps Training Command with headquarters at Ft. McClellan, Ala., since 1953.

He was born in Washington, D.C., Sept. 2, 1902, attended the United States Military Academy and was commissioned in the Infantry in 1926. He transferred to the Chemical Corps in 1934, was sent to M.I.T. where he obtained a Bachelor's Degree in Chemical Engineering in 1937. He fathered the idea for a chemical warfare testing station in the West, located and laid out Dugway Proving Ground, Utah, which he then commanded for three years. He served in the Pacific during the war as Chemical Officer of the Sixth Army and later of the Eighth Army. In 1947, he returned to this country, joined Headquarters, First Army, and in 1951 was assigned as Chief of Personnel of the Chemical Corps. His present assignment dates from 1953.

He has been awarded the Legion of Merit and Oak Leaf Cluster and the Army Commendation Ribbon.

Marshall Stubbs

As head of the Materiel Command, General Stubbs has his headquarters in Baltimore, Maryland.

Born in Superior, Nebr., June 13, 1906, he was graduated from West Point in 1929 and commissioned in the Infantry. He transferred to the Chemical Corps in 1934 and, he too attended M.I.T., where he obtained a Master's Degree in Chemical Engineering.

General Stubbs in the early part of the war was engaged in the incendiary bomb development of the Chemical Corps and later went to Denver to initiate construction for the Rocky Mountain Arsenal. In 1943 he went to Europe and served in the headquarters of the Eighth and Ninth Air Forces. Shortly before the invasion of Normandy he joined the Advance Base Section, Communications Zone, staff. He returned from Europe in 1947 for duty in the Research and Development

Division at Edgewood, Md., and in 1951 attended the National War College.

General Stubbs has been awarded the Legion of Merit, the Bronze Star Medal, the Army Commendation Ribbon with Oak Leaf Cluster, the Ordre de Leopold and The Croix de Guerre with Palm (Belgian).

CHEMICAL CORPS BRIEFS

CHEMICAL CORPS ORGANIZATION

It is understood that the Chief Chemical Officer intends to appoint a Committee to study and make recommendations to him in regard to the organization and functions of the Chemical Corps, the Committee to be selected principally from leaders in industry or education. Among the specific matters for inquiry are the following:

(1) Whether the assigned missions of the Chemical Corps should be enlarged or contracted.

(2) The feasibility of conducting portions of the program by contractual means with industrial, scientific and educational institutions.

(3) Changes aimed at strengthening the organization and improving the operation of the Office of the Chief Chemical Officer.

(4) Corps-wide organizational changes with a view to delegation of greater responsibility to key assistants.

ABOLISH UNIT GAS OFFICER POSITIONS

New regulations abolishing the positions of unit CBR officers and CBR non-commissioned officers, formerly designated as unit gas officers, were referred to by Maj. Gen. Charles E. Loucks, Deputy Chief Chemical Officer in addressing the 1954 graduating class in the advanced course in the Chemical Corps School at Ft. McClellan, Alabama, last June. He spoke of this change as having resulted from approximately two years study and commented that the responsibility for training and readiness for operations in respect to CBR has now been more definitely placed upon troop commanders. General Loucks also noted that recent instructions from the Department of the Army direct CBR training be included in all Army training programs, including field exercises and maneuvers.

General Loucks told the graduates that the future of the Chemical Corps rests largely upon them, stating, "it will in fact depend very much upon you whether it is we or our enemies who first produce new developments and bring them to military effectiveness."

GEN. BURNS TO HEAD R&E

The Chemical Corps has announced that Brig. Gen. John R. Burns, Chief of the Chemical Corps Training Command with headquarters at Fort McClellan, Alabama, will assume command of the Army Chemical Center and the Chemical Corps Research and Engineering Command on September 1.

Other announced changes include: Col. William R. Currie, now Deputy, to replace Gen. Burns as head of the Training Command; Col. William E. R. Sullivan to the office of the Chief Chemical Officer as Executive Officer, replacing Col. DeLancey R. King, who has a new assignment in the office of the Assistant Chief of Staff, G-4 Logistics, Department of the Army.

ARMY SAFETY AWARD

ARMY CHEMICAL CENTER, MD., For its low accident frequency rate for the year 1953, as compared to the average accident and injury rates for 1951 and 1952, and its all-around accident prevention program, the Army Chemial Center received the Department of the Army Award of Merit for Safety.

The 1953 accident rate reflected a reduction of 34% over the two previous years.

Although this is the first time the Chemical Center has received the Department of the Army award, last year two other safety awards were received, one from the National Safety Council and the other from the Armed Forces Chemical Association.

DR. KATZ RETIRES

ARMY CHEMICAL CENTER, MD.—Forty years of Government service without a day of sick leave is the unique record held by Dr. Sidney M. Katz, former consultant at the Chemical Corps Chemical & Radiological Laboratories, Army Chemical Center, Md.

Dr. Katz retired in May this year after serving at the Chemical Center 25 of his 40 years a federal employee. At a retirement ceremony he received a letter of appreciation for his valuable service presented by Major General William M. Creasy, Chief Chemical Officer, who was then the Army Chemical Center Commander.



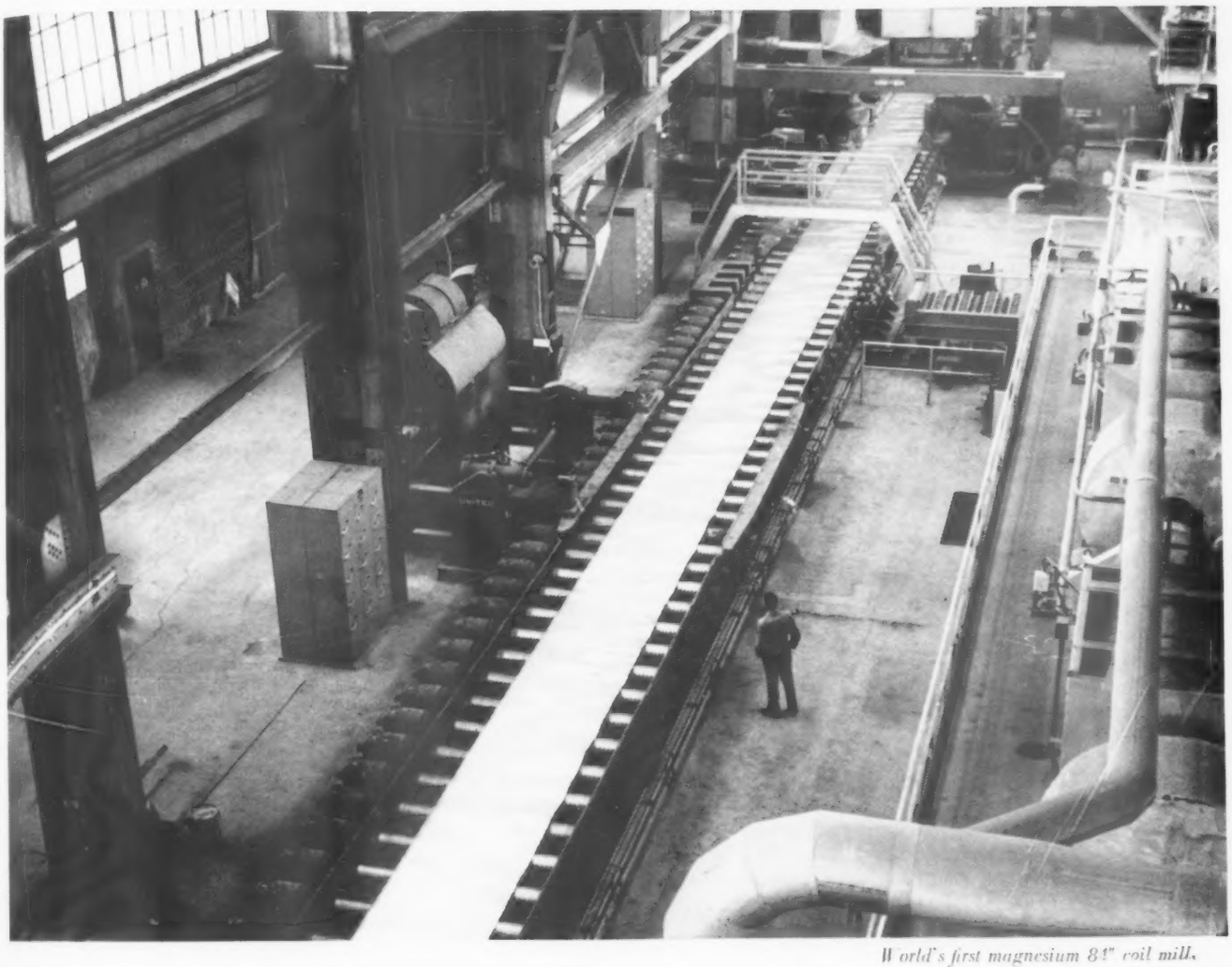
PHOSPHATE WORKS AT MUSCLE SHOALS

In a recent statement released to the press, Major General William M. Creasy, Chief Chemical Officer, Department of the Army, disclosed that the classified Army Chemical Corps Plant located on the TVA Wilson Dam Reservation at Muscle Shoals, Alabama, is engaged in the manufacture of chemical compounds used in the production of nerve gas, popularly known as G gas. It has previously been announced that such gas is being made at Rocky Mountain Arsenal, Denver, Colorado.

This plant presently known as the Muscle Shoals Phosphate Development Works, was started in late 1950 and completed in 1953 at an approximate cost of $50,000,000. It was designed by the Vitro Corporation of America and constructed by the Southern Constructors under the supervision of the Corps of Engineers.

(Continued on page 39)

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SENIOR OFFICER RETIREMENTS

As the Journal went to press information was received of the retirement this summer of seven senior officers of the Chemical Corps, Colonels Raymond T. Beurket, Robert D. McLeod, Jr., and Leonard M. Johnson retiring on July 31; Brig. Gen. Leonard J. Greeley, Col. Frederick W. Gerhard and Col. Norman D. Gillet on August 31 and Col. Alexander Grendon on September 30.



COLONEL BEURKET was born at Honesdale, Pa., Nov. 22, 1899, attended the U.S. Military Academy and was commissioned in the Field Artillery in 1924. He transferred to the Chemical Warfare Service in 1936. In World War II he served as Director of the Troop Training Division, Hqrs. Army Service Forces. Post war assignments included duty as commanding officer, San Jose Project, Panama, C.Z., and Western Chemical Depot, Utah. His last assignment was Chemical Officer of the Second Army stationed at Ft. Meade, Md.



COLONEL MCLEOD was born in Leadville, Colo., March 23, 1901, was graduated of the U.S. Naval Academy in 1924 and commissioned in the Chemical Warfare Service of the Army. He obtained a Master's degree in Chemical Engineering at M.I.T. in 1938, and his subsequent assignments include a number of technical positions. During World War II he had extensive service with the Air Force. After the war he served as Chemical Officer, Hqrs. Third Army, and adviser to the Historical Branch at A.C.C.



COLONEL JOHNSON, President of the Chemical Corps Board at the time of retirement, was born in Wisconsin May 4, 1897. He served 37 years in the Regular Army, 32 years as a commisioned officer. He entered the Army in 1917 as a flying cadet, and was commissioned in 1922, in the Field Artillery, transferring to the Chemical Corps in 1937. During World War II he served in England, North Africa, Italy and Norway. In the latter country, Col. Johnson, who speaks Norwegian, was assigned just after VE-Day to supervise the demilitarization of German chemical munitions. During the period 1946-1949 he was military attache to Sweden.

He is an alumnus of the University of Wisconsin; he also studied at Harvard as a student officer.



GENERAL GREELEY was born in Omaha, Nebr., July 9, 1901, attended the University of Kansas and was appointed 2nd Lieutenant, Field Artillery in 1923. He joined the Chemical Warfare Service in 1936. In World War II he served as Deputy Chief of Staff of the U.S. Army Forces, South Pacific Area, from 1942 to 1944, when he joined the Ground Plans Division of the Army Air Force in the Pacific Ocean area. Among his assignments after the war was that as Chief Chemical Corps Training Command, Ft. McClellan, Ala. His last post was that of Deputy commandant of the Industrial College of the Armed Forces.



COLONEL GILLET was born December 29, 1896, at Newport News, Va. He was graduated from Virginia Military Institute in 1918. He received a commission in the Infantry, National Army in Aug. 1918 and was commissioned in the Regular Army in 1920. In 1924 he transferred to the Chemical Warfare Service. Col. Gillett served as Chief of the Supply Division, Chemical Warfare Service, in World War II. His post war assignments included duty as Deputy Post Commander, Army Chemical Center, and key positions in the Munition Board, Department of Defense. His last assignment was Chief of the Administrative Division, office of the Chief Chemical Officer.



COLONEL GERHARD was born in South Dakota on October 26, 1896. He was graduated from the United States Military Academy in 1918, and commissioned in the Coast Artillery Corps, transferring to the Chemical Warfare Service in 1929. He attended MIT and obtained a Master's Degree in 1933. Col. Gerhard was engaged in technical development work during part of World War II. His post-war duties included tours as assistant military attache, London, and as Commandant of the Chemical Corps School. His last duty assignment was that of post commander, Army Chemical Center.



COLONEL GRENDON was born in New York on September 1, 1899. He has both a Bachelor's and Master's Degree in Engineering from Columbia University. Col. Grendon served in World War I as an enlisted man in the Signal Corps. In World War II he served as an instructor in Radar at Ft. Monroe, Va., and later as Radar Officer in the Asiatic-Pacific Theater. Col. Grendon was appointed a Major in the Coast Artillery Regular Army in 1947 and subsequently joined the Chemical Corps. He is a graduate of the 4th Radiological Defense Course of the Chemical Corps School, also a graduate of Post Graduate School of the Navy.

TO CHAPTER SECRETARIES

Material for the JOURNAL should be in the Editor's hands five weeks before the first day of the month of publication.—ED.

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ATOMIC DEFENSE TRAINING

AT THE CHEMICAL CORPS SCHOOL

By LIEUTENANT COLONEL CHARLES S. BRICE, JR.*
and MAJOR C. H. COLGIN†

THE fact that atomic shells and bombs are rapidly assuming the status of conventional weapons, coupled with the building up of stockpiles of atomic bombs by other nations, makes almost certain the extensive use of such weapons in the event of any future war. This brings up the questions: what will be the Chemical Corps role in atomic warfare, and what steps are being taken by the Chemical Corps to insure that all of its officers are thoroughly qualified to assume responsibilities in this field.

One of the best indications of what commanders of major tactical units expect of the Chemical Corps in this field is the fact that a large proportion of the Chemical staff officers in overseas theaters are being employed primarily as atomic staff officers. The reasoning behind this is that although it is vitally important for us to be prepared for the employment of chemical and biological weapons, we do not know for certain that they will be used. On the other hand, it is more or less a foregone conclusion that atomic weapons will be used in combat. Therefore, why not use the chemical staff officer in the field of most immediate concern of the three in which he is assumed to be expert? Here is a wonderful opportunity for the Chemical Corps to further its reputation for being thoroughly competent both technically and in staff planning; or, conversely, lack of a thorough knowledge of the atomic weapons field by any Chemical Corps officer could be highly detrimental of the prestige of the Corps. The atomic and radiological defense training programs

*Chief, Radiological Branch, Chemical Corps School, Fort McClellan, Alabama.
†Director, Radiological Laboratory, Chemical Corps School.

within the Chemical Corps School are designed, in part, to give Chemical Corps officers a grounding in both the theoretical and practical aspects of atomic and radiological defense. Such a background will in turn enable an officer to become, with additional individual, study competant in the planning for the offensive use of such weapons.

Although regulations provide for a Chemical Corps role in the employment of radiological weapons, no such offensive role is provided for in the case of atomic weapons. The Chemical Corps does have definite responsibilities in the planning, training of personnel, and furnishing of technical advice in the field of radiological defense. Since, in the case of atomic weapons, the radiological effects are so closely associated with the blast and thermal effects that it is impractical to divorce one from the other in defensive planning, the term radiological defense has come to be considered as synonymous with the term atomic defense. Similarly the defensive aspects of atomic warfare cannot be completely separated from the offensive aspects. An atomic defense officer who can advise a commander on the effects of an enemy atomic weapon on our troops can equally well advise him on the effects of one of our own weapons on enemy troops. Chemical Corps officers are right now being used in the planning for the employment of atomic weapons.

Protection Possibilities of Smoke

Of particular interest and importance to the Chemical Corps is the great effect of different atmospheric visibilities on the transmission of thermal radiation (heat) from atomic bombs. A light haze can reduce the thermal radiation that would be received on an exceptionally clear day by a factor of fifty or more.* This is true whether the haze is natural or man-made. The wide availability of this information on an unclassified level has caused numerous persons to make the very obvious suggestion that smoke be produced specifically for this purpose. Its application in combat situations might be of great importance. Troops in the open, such as in an attack or withdrawal, in river crossings, or in amphibious operations, would be extremely vulnerable to the heat from an atomic detonation. In such situations a few well placed atomic weapons might wipe out entire commands, primarily by thermal radiation effects. On the other hand, if this heat could be decreased by means of smoke, casualties from this cause might be reduced by a substantial factor. Smoke used for this purpose would be produced by Chemical Corps units. Any such application would require that Chemical Corps officers have a thorough knowledge of thermal radiation from atomic weapons, the effects it produces on different materials, and the mechanisms by which it can be attenuated.

Radiological defense in its narrowest sense, i.e., protection against nuclear radiations, is becoming increasingly important. Although ground contamination from air bursts is normally insignificant, in the case of surface or subsurface detonations, residual nuclear radiations may be more effective than either blast or thermal effects as a producer of casulaties. Personnel protected either by distance or by shelters from the immediate effects of this type of detonation could receive lethal doses of residual nuclear radiations unless evacuated from the area immediately. Troops or rescue teams crossing such areas might easily become fatal casualties. The Chemical Corps responsibilities in such situations would be great. Of vital importance would be immediate aerial surveys of ground contamination by atomic defense personnel to determine which areas must be evacuated. Any delay or lack of experience in this field would be measured in human lives. Chemical Corps officers would have to advise on when rescue teams could enter such areas and for how long they could remain in them, and when troops could cross them; these officers also would have to supervise decontamination of personnel and equipment, and advise on the decontamination of food and water supplies.

In the case of natural disasters such as large floods, in the past, local facilities have been so disrupted and overtaxed by the magnitude of the destruction that it has been necessary to call on troops in the area to help out in the emergency. It would be extremely foolish and unrealistic to imagine that in the event of the far vaster destruction resulting from the detonation of a large fission or thermonuclear weapon on a city, all troops and other agencies within hundreds of miles would not be called upon for all possible aid, particularly in view of the fact that local organization and facilities would be largely destroyed. In the case of a contaminating detonation, Chemical officers, as the Armed Forces experts in atomic defense, would naturally be called upon to play a leading role. Not only would Chemical staff officers be called upon to advise in such an emergency, but also both officers and enlisted personnel from Chemical Corps troop units and supply installations would be needed to supervise and assist on survey, monitoring, rescue, evacuation, and decontamination operations. A sound knowledge of the problems involved and aggressive leadership on the part of these officers could result in the saving of thousands of lives. Will the Chemical Corps be capable of handling such vital operations if the occasion ever arises? That depends upon whether the Chemical Corps School succeeds in one of its most important objectives: to make atomic defense experts of every officer in the Corps.

Atomic Defense Responsibilities

Before going into what the School is doing to accomplish this objective, let us briefly summarize the Chemical Corps atomic defense responsibilities. In general, the Chemical Corps is responsible for the development and supervision of the Army radiological (atomic) defense organization, formulation of radiological defense doc-

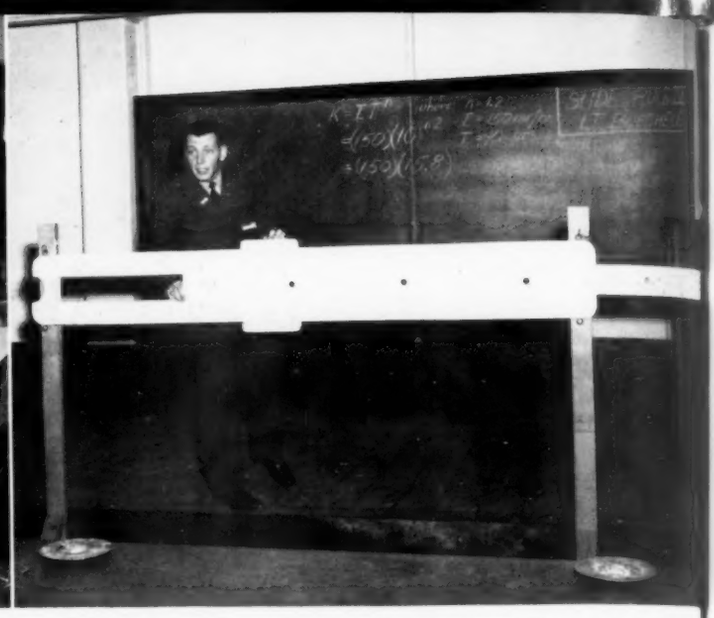


COL. CHARLES S. BRICE, JR. MAJOR C. H. COLGIN

*See "The Effects of Atomic Weapons" (unclassified) Fig. 6.36.



Lt. G. F. Carroll, School Rad Safety Officer, and Cpl. P. R. Jones prepare issue-rack for film badges and electro-static pocket dosimeters. Badges and dosimeters (resembling fountain pens) are serially numbered, issued to students for duration of course.



LT. J. E. Buechele operates giant-sized functional slide rule in teaching large groups of students the component scales and how to use them.

trine, training of radiological defense personnel and supervision of training programs, furnishing of technical advice, providing trained staff personnel, making radiological surveys, monitoring and decontamination, production of smoke, supply activities, and certain radiological research and development activities.

In order for the Chemical Corps to carry out its atomic defense responsibilities, it is essential that its personnel be thoroughly trained in this field. The Chemical Corps is not only responsible for the training of its own personnel, but also for the atomic defense training of the Army as a whole and for certain key personnel in the Navy and Air Force. This training is given at Fort McClellan, Alabama, in the Chemical Corps School of which Colonel Edwin Van Keuren is the Commandant. The School is a part of the Chemical Corps Training Command, commanded by Colonel John R. Burns.

The most advanced course given on atomic defense at the Chemical Corps School is the six-week Atomic Defense Officer Course. The purpose of this course is to train Chemical officers and selected officers of the Armed Forces to serve as staff advisors at division or higher levels in the duties and responsibilities for atomic defense measures, procedures and techniques. Enough of the basic sciences and nuclear physics is covered to give the student an understanding of the principles behind the atomic bomb and its effects, and to enable him to apply his knowledge to new and changing conditions. The theory and principles of radiation detecting instruments are taught, followed by the actual use of these instruments by the student. Protective measures and medical aspects are given, and a considerable amount of time is devoted to the study and calculation of weapons effects, with particular emphasis placed on the practical aspects. Problems in staff planning are given and each student is required to write staff plans. In the Radiological Laboratory the student is given an opportunity to handle radioactive isotopes, use radiation detecting instruments to run various types of surveys of ground contamination, decontaminate equipment, and perform various other operations that he may be called upon to either do himself or to supervise in the future.

The purpose of the Atomic Defense Officer course is not to train specialists; it is to provide the absolute minimum background necessary for any Chemical Corps officer regardless of his past or future assignments. Without this training or its equivalent at Chemical Corps officer can no more be considered qualified in his branch than if he lacked knowledge of Chemical or Biological Warfare. For this reason this course with certain modifications is given as a subcourse of the Chemical Officer Advanced Course. It is not to be inferred that a course of such short duration as the Atomic Defense Officer Course can, in itself, qualify officers to the degree expected by the Army of officers of any technical branch in the fields of its responsibilities. It does, however, give a sufficient background and insight into the subject so that an officer through additional study by himself can become well qualified. As evidence of the feeling of officers trained in this subject, a great majority of the members of the last two advanced classes have recommended that the time allotted to this subcourse be increased above the present six weeks.

Comparison with Other Courses

In the past there has been some confusion as to whether the Atomic Defense Officer Course as given at the Chemical Corps School duplicates matter contained in the Special Weapons Employment Course as given at Sandia Base and at Fort Leavenworth. Actually there is little duplication. The Special Weapons Employment Course covers in detail the planning for the tactical employment of atomic weapons against an enemy, but it in no sense of the word qualifies an officer for the decontamination, survey, and laboratory procedures, protective measures, and defensive staff planning necessary for atomic defense. Both courses, of necessity, go extensively into the study of weapons effects. The Atomic Defense Course does, by virtue of its coverage of the effects of enemy weapons on our own troops and of protective measures against such weapons, give a sufficient background to an officer to enable him with a certain amount of additional study to plan for the tactical employment of atomic weapons. However, this certainly is not as satisfactory as attending the Special Weapons Employment Course, and any Chemical Corps officer who may in the future receive staff assignments should attend both courses.

Thirty-five hours of atomic defense instruction are given in the Chemical Officer Basic Course. While this is insufficient to enable an officer to carry out any but the very simplest of tasks in the atomic defense field, it does orient him to the extent that he can do this type of work under the supervision of an officer more experienced in atomic defense procedures. In order to remove this limitation, and in line with the policy of keeping

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Using scale model, Lt. C. C. Wales, USN, explains construction and operation of nuclear reactor. Naval students show particular interest due to current applications in the fleet.

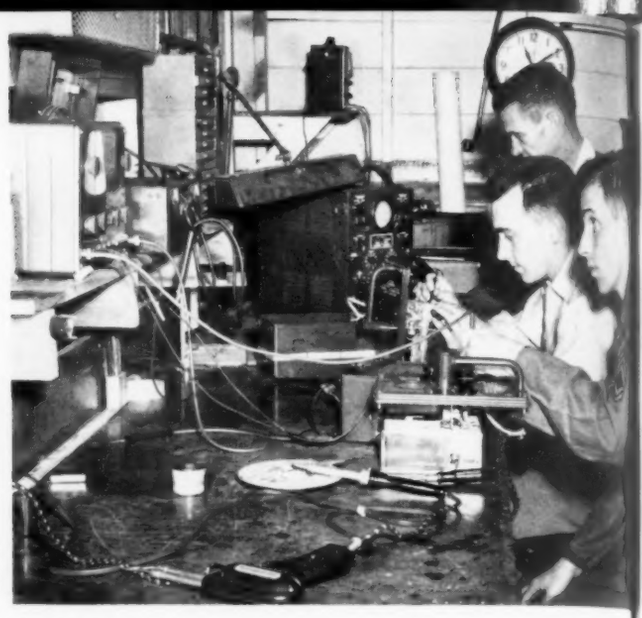
abreast of the latest trends and developments in warfare, the Chemical Corps is considering recommending the incorporation of a major portion of the six-week Atomic Defense Course as a subcourse of the Basic Course.

Among the other courses in which thirty to fifty hours of atomic defense instruction are given are the Naval ABCD (Atomic, Biological, and Chemical Defense), CBR (Officer) CBR (Enlisted), Chemical Laboratory Enlisted, and Chemical Staff Specialist Courses.

The Chemical Corps School conducted a considerable part of the initial training of the 1st Radiological Safety Support Unit, commanded by Major Donald G. MacWilliams. This unit was activated 1 July 1953, for the purpose of furnishing radiological support at atomic weapons tests, both at the Nevada Proving Grounds and the Pacific Proving Grounds.

A Geiger-Mueller survey meter (lower right) is used to check the thoroughness of decontamination of vehicle and personnel, following completion of survey.





A thorough maintenance program is essential to insure proper and accurate functioning of instruments. In picture, Mr. K. Hail (rear) supervisor of maintenance; Mr. J. W. Nichols, electronic technician (center) and Sfc. L. J. Jones, 1st RSSU.

In addition to its training activities, the Chemical Corps School also furnishes technical advice to other agencies of the Armed Forces and engages in research on practical problems. One of the most significant contributions made by the School is the set of *nomographs* developed by Lieutenant Michael M. Mryczko. These nomographs provide a means of predicting atomic weapons effects which is simpler and more rapid than any hitherto published and which could profitably replace the methods currently used by the Armed Forces in planning for the employment of atomic weapons. With this in view, they have been submitted by the School to higher headquarters, with recommendation for adoption. Although they have not yet been accepted officially, the nomographs have been published by the School and have proved to be outstandingly successful as an instructional aid. In addition to being much more rapid this method is easier to learn than the ones currently in use and decreases the chance of making errors.

The effective presentation of a subject of such a complex nature as atomic defense requires the maintaining of a highly qualified group of instructors. These instructors are largely selected from officers attending courses at the School, based upon personality, class standing, physics background in college, radiological experience, and manner of presentation of instruction. Every effort is made to insure that all platform presentation is both interesting and instructive. However, the limited amount of time allotted to the various subjecs covered often does not permit as extensive a coverage as many of the students desire. For this reason many additional hours are frequently scheduled in the evening at the request of the students. Usually the larger part of the class attends this additional instruction, and a great deal of interest and enthusiasm is shown by all participants. An average of fifty to sixty such evening hours has been scheduled for each Atomic Defense Officer Class.

Practical Training Essential

Although a theoretical background is essential for an understanding of the subject and for flexibility in application under different conditions, practical exercises are absolutely necessary to enable the student to become proficient in atomic defense procedures. A person can no more become capable of properly running a radiological

(Continued on page 33)

THE ECONOMIC CONSEQUENCES OF ATOMIC ATTACK

(This condensation, prepared especially for the JOURNAL, of an address delivered May 5, 1954, at the Industrial College of the Armed Forces, Washington, D.C., is published by permission of the author and the Commandant of the College. In introducing Professor Cavers, Dr. Louis C. Hunter, of the college faculty, referred to him as having been the first to explore some of the less obvious implications of atomic war for economic mobilization.—Editor)

By DAVID F. CAVERS*

Associate Dean, Harvard Law School, Cambridge, Mass.

Our Basic Purpose

This paper is primarily concerned with the economic problems involved in fighting a successful war while sustaining an atomic attack. This, I am convinced, is essentially a problem of the *unbombed* areas. How are they to keep functioning to provide a sufficiently firm civilian base for continuing military operations? We have to make sure that, if the war is to be abruptly terminated by a general social and economic collapse, it is the other side that collapses.

In planning to prevent the collapse of our economic system, I think that in some respects we have a more difficult job than does the Soviet Government. We have a much more intricate economic and social organization than do the Soviets. The fact that we are not a regimented, monolithic economy enables us to produce in tremendous volume when conditions are basically normal, as they were during World Wars I and II. When normal conditions are broken, however, we have to substitute a new pattern of direction for the working of the price, contract, and credit system. That system ordinarily keeps our economy humming through billions of daily decisions by millions of people.

Because the danger that this system may collapse is a real one, effective planning to prevent it seems to me one of the best ways to deter attack. The chance that an unprepared, overly optimistic economy could not stand up under the shock of destruction on the scale we are assuming might sometime prevent an attractive gamble to rulers willing to pay a large price in their fellow citizens' lives to win world dominion. Recognition that we were braced to stand heavy losses ourselves would dampen any such optimism.

If our basic purpose is to keep our economy in fighting trim, we must avoid excessive concentration on the bombed areas. This focus may be appropriate for the Federal Civil Defense Administration, but I submit that the functioning of the unbombed areas is the more vital problem.

Some Assumptions

Any consideration of this problem requires some assumptions as to what areas are likely to be attacked. The Industrial College of the Armed Forces, in setting the problem for study, has adopted a set of assumptions developed by the Federal Civil Defense Administration. Twenty major cities and industrial areas are assumed to have been attacked, one A-bomb having been dropped on the center of each, killing 4,227,700 people and seriously injuring 2,758,800.

There are important advantages in posing a problem for initial study in terms sufficiently simple to render it manageable. Destruction of the dimensions I have just described represents such a simplification even though it would, of course, impose a tremendous strain on the national economy. Some of the simplifying assumptions are so significant for the subject of this paper that I should like to call attention to them briefly, despite my inability to pursue all their implications here.

First, I believe it improbable that, if attacked, a large city like New York or Chicago would be hit by only one bomb, unless that bomb were an H-bomb, capable of devastating at least as much as several A-bombs. Second, if we postulate the continuance of the war beyond the first few cataclysmic days, subsequent atomic attacks would almost certainly be made, although probably on a diminishiig scale and tempo. Third, the initial strike might be a surprise daytime attack, perhaps executed by guided missiles launched from enemy vessels and directed against Washington and our seaboard commercial and financial centers. Fourth, through a winter attack would create terrible complications, the attacking side would be similarly exposed; a spring attack would therefore seem more likely. Fifth, the spectacle of atomic attacks and counter-attacks might well serve to neutralize Western Europe, with the probable exception of the United Kingdom.

Problems of Civil Defense and Military Procurement

So vast and intricate are the problems with which this paper deals that it will be necessary to deal briefly with all topics and summarily with some. Because of the relatively greater importance of the unbombed areas to its subject, I am going to pass by the grim and difficult questions by the bombed areas: How are the refugees to be housed and fed? How are the vast numbers of injured to be cared for? How is order to be maintained? These questions are important from the standpoint of winning the war chiefly for two purposes: (1) to maintain morale in the cities which are threatened with attack but have not yet sustained it and (2) to make effective use of the facilities which are still in working condition in the areas surrounding the areas of large-scale destruction.

*Professor Cavers is Fessenden Professor of Law and Associate Dean of the Harvard Law School, Cambridge, Mass. He was born in Buffalo, New York, 3 September 1902, obtained a B.S. degree, from the University of Pennsylvania in 1923 and LL.B., from Harvard in 1926. Following a period in law practice he became an instructor in Harvard in 1929. He has been a faculty member, either resident or visiting, of the law schools of West Virginia, Duke and Yale Universities and the University of Chicago. He has held a number of advisory or consulting positions with Government agencies. He has been a member of the Research Advisory Board of the Committee for Economic Development since 1943, served as associate general counsel, OPA, from 1943 to 1946 and as legal adviser to the Department of Agriculture in drafting food and drug bills.

Another matter which I am planning to deal with briefly is one with which you have a peculiarly direct concern—the question of maintaining military production. Perhaps a third world war would have to be fought largely out of inventory and, maybe, by the time the inventory was exhausted productive facilities would be very few. In any event I shall deal only briefly with the military supply problem because I feel that, from the planning standpoint, it is rather more manageable than the problem of maintaining the functioning of the economy generally. Yet the latter objective must be achieved if military production is to be maintained. However, there are a few points that doubtless have already entered into your planning which I shall note here simply to fill in an important part of the general economic picture.

First, I assume that at least the most important procurement contracts will deal with two alternatives: (1) that the contractor will sustain war damage crippling or destroying his ability to carry out the contract or (2) that other contractors producing the same materiel have been thus damaged. I believe useful arrangements can be made for the Government's shifting an order in whole or in part from the damaged contractor to the undamaged contractors and also for concurrent switching of subcontracts and suppliers' contracts. This should not be left to postattack negotiation.

Second, since most producers for Government accounts are also engaged in civilian business, and since the drastic curtailment of this may undermine their financial stability, arrangements should be incorporated in procurement contracts for Government guarantees of the contractors' credit insofar as they need credit to continue Government operations after an attack.

Third, the Government should have its option to transfer equipment, unfinished goods, and supplies from damaged contractors to undamaged contractors. Similarly, contractors should agree to accept this.

Arrangements of this sort might have to be left in general terms for some industries, but for others specific sets of alternatives could be spelled out and coperative plans drawn up in advance. If this should present antitrust problems, then legislation is called for to obviate them.

Fourth, some plants might be damaged in locations where the renewal of attack did not seem likely. Provisions should be made for the rapid restoration of such plants on Government credit where that would be needed and with priorities for construction labor and materials.

Shifts in Urban Population

A puzzling problem that must be reckoned with in planning to maintain the warmaking potential of the unbombed areas is how their populations would behave. A critical question, for example, would be the behavior of the populations of large unbombed cities which appeared to be good target areas. Take, for example, Buffalo and the Niagara Frontier, which are not included among the twenty target areas. Certainly the people of Buffalo would be entitled to expect that if they were not chosen in the first wave of attacks, they soon would be. And the terrific losses sustained by the attacked cities would lead most Buffalonians to get moving. The fact that evacuation is now considered as a mode of civil defense would stimulate the exodus.

Where would they go? It happens that there are no medium-sized cities near Buffalo and Niagra Falls; only small cities like Lockport, Batavia, Jamestown, Dunkirk, and St. Catherines, Ontario. Probably the outskirts of Buffalo and other threatened cities would be swarming with refugees from their centers—again something that would be less likely if our target areas had been hit by H-bombs or several A-bombs.

Obviously this type of evacuation would create feeding and shelter difficulties of great proportions, but, as we must keep in mind, it would also greatly affect the way the economy could operate. Shortly after the initial attack had been sustained, I think we would find that the Nation could be divided into four types of communities in terms of population shifts. For convenience I shall identify them as classes A, B, C, and D.

The Class A communities would be comprised of the cities actually attacked. They would be badly disorganized by the physical damage sustained. The destruction of utilities would present an especially serious problem there. Probably large-scale evacuation of even the surrounding areas should be encouraged.

Class B would comprise the cities which I have exemplified by Buffalo and the Niagara Frontier, cities whose inhabitants would assume that they might be next on the attackers' schedule. Since a high proportion of the inhabitants would have fled, a major problem would be to reconstitute working forces.

Class C communities would be those which had been close enough to the class A and B communities to sustain a flood of refugees.

Class D communities would be those which were sufficiently remote not to be flooded by refugees and not to be likely target areas. Many communities would, I think, shift themselves from class B to class D after the initial shock had worn away. However, some class D communities would certainly become class C communities as refugees from Class A and B cities spread themselves over more territory.

The Phases of the Postattack Problem

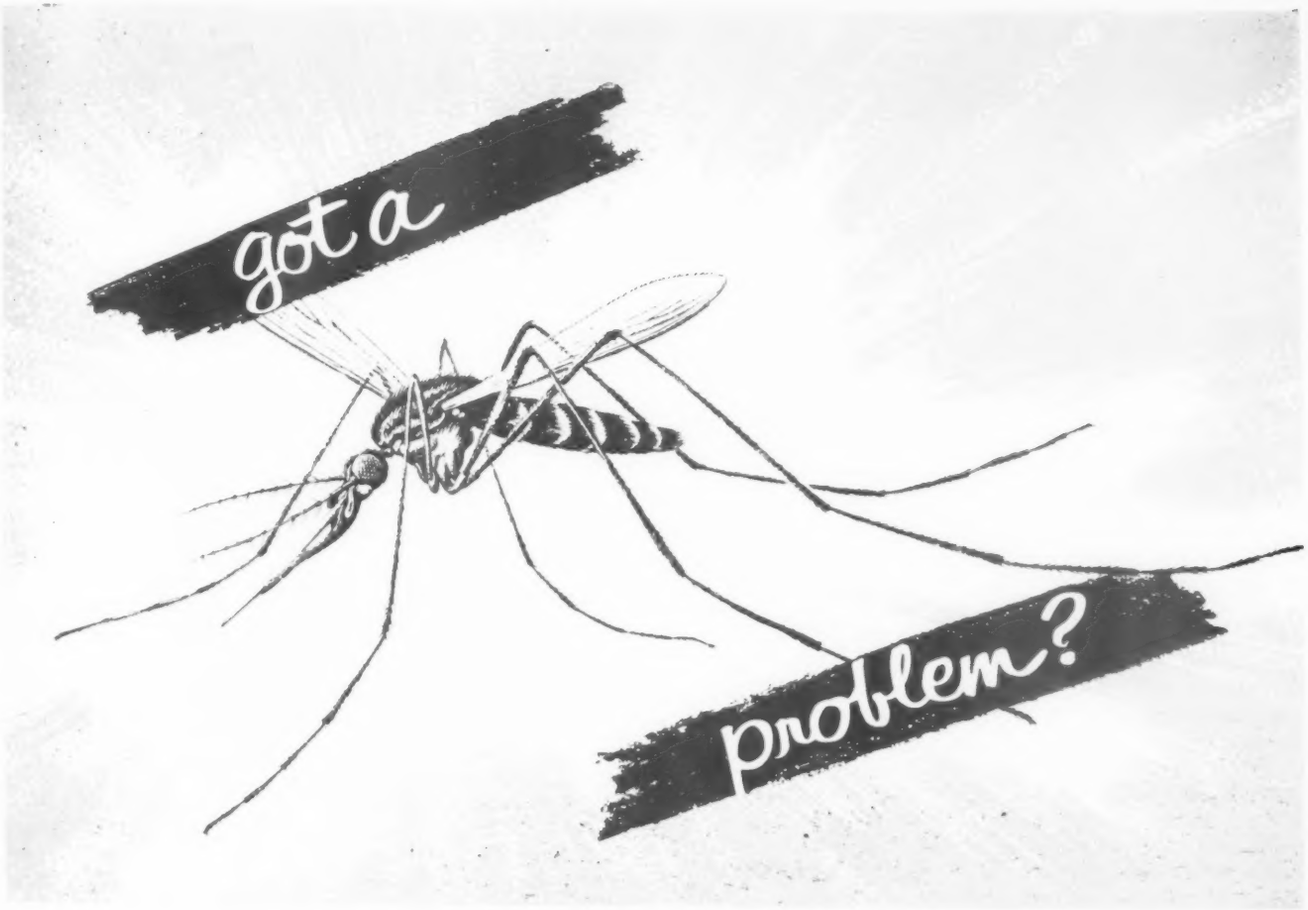
Let us take my assumption that there would be a simultaneous initial assault on a large number of cities followed by a continuation of strikes at intervals on smaller numbers of communities, perhaps reaching some less open to attack than those first chosen. If so, I think we can divide the economic consequences of the attacks into three phases: (1) the period of initial shock, (2) the period of sustained war, and (3) the postwar period. We should try to plan the handling of the first two periods so as to prevent economic collapse in the postwar period.

In approaching the problems of the first two periods, we should not be captive to the ideas that dominated our economic planning in World War II. This comment may seem both obvious and unnecessary. However, I understand that serious thought has been given to resort to World War II plans with relatively minor modifications in the expectation that the World War III experience would differ only in degree from experience in World War War II. I think this is a dangerously wrong belief. In World War II, not only was the transition to a wartime economy gradual, but we maintained substantially the pattern of our peacetime economy throughout the war. We chiefly changed the nature of our hard-goods output. Moreover, productive activitiy within the bounds of the country was not affected by enemy action, and the Government itself did not have to cope with a bombing of Washington and other centers of governmental control.

The Period of Initial Shock

How long the period of initial shock would last is a matter that would depend on the tempo of the enemy strikes. Assuming that most of them came at the start, I should think the initial traumatic reaction might last two or three weeks.

Consumer Demand— Consider first in that period the demand for goods. Some economists appear to assume that the attacks would touch off a wave of frantic buying with immediate inflationary effects. My own view is that the consumers' demands would be sharply differentiated.



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Absent rationing, the demand for food, particularly canned food, in the Class A, B, and C communities, would be great. In the Class A cities, exhaustion of existing supplies would appear imminent and hoarding would be natural. In the class B cities, people would be preparing for flight and stocking up their cars in consequence. The class C communities would be hard put to feed the newcomers.

In the class A cities I doubt there would be much demand other than for food. Major stores, moreover, would have been destroyed. In the class B cities, special goods such as camping equipment would be in sudden demand, but the supply would be soon wiped out. In general, people would not want to be encumbered by more goods than they already had. Furthermore, they would be short of cash. People who lacked cars would try to get them. I should hope all cars in stock in danger areas would be requisitioned by the civil-defense authorities.

In the class C cities and towns the influx of refugees would result in a high demand for practical clothing and for certain house furnishings and utensils. Incidentally, most electric appliances would be a drug on the market, but old-fashioned cook stoves would be priceless.

Distribution—All that I have been discussing so far relates to consumer purchases at retail. What would the distributors be doing? Many stores in class B cities probably could not open for want of personnel. Those which did open would probably sell chiefly on a cash basis. Except for the food stores, probably there would be little dealing with wholesale distributors. In the class C areas, in contrast, desperate efforts would be made to reach new sources of supply, and some shifting of stocks from B to C areas might occur.

Manufacturing—In many class A and B cities, manufacturing would stop. Even in the class D areas, some industries would close down because their markets were so obviously disrupted. Markets would be gone in the class A cities and badly damaged in the class B cities. For most luxury goods or expensive heavy items, no prospect of a market sufficient to sustain operations would appear anywhere on the national horizon.

Money and credit—Looking simply at demand, therefore, we can see inflationary pressures developing only in certain commodity areas of the economy and accompanying them would be the drastic deflation of many others. However, to round out the picture, it is necessary to speculate as to the state of money and credit.

I should suppose that everywhere on the heels of an attack there would be great runs on the banks, provided the banks were open at all. These runs would be due in part to lack of confidence in the banking system, but perhaps still more to the desire for money to finance flight.

This situation is obviously one that could be prevented from becoming serious by precautionary measures. I believe that the undestroyed banks should be kept open, special obligations to stay on the job having been undertaken by their personnel. Withdrawls should be limited to a previously determined and announced maximum, say $100 per depositor once a week. Greater withdrawals should be allowed for specified business purposes, such as supplies and payrolls. Perhaps special, partial guarantees should be extended to all deposits.

Immediately after the initial attack, a nationwide moratorium should be declared on all debts except bank deposits to the extent suggested above and perhaps accrued claims for wages and salaries. Also, perhaps the privilege of paying a part of the latter in scrip, say, up to 50 percent, might be allowed.

Needless to say, the securities markets which had survived should be closed and also the commodities markets. This would not prevent privately negotiated transactions.

Rationing—Obviously, during the initial period there would be need for rationing in class A, B, and C communities. The system slowly evolved in World War II would not serve in this emergency. A crude type of control could be exercised by sellers or by police. Better forms could doubtless be devised in advance.

In class C communities, purchasing by refugees might be limited to purchase orders issued by whatever body could be set up to administer the local supply. No doubt a price freeze would be proclaimed, but enforcement would have to depend chiefly on the sellers' conscience and public opinion toward gouging.

The Period of Sustained War

As the tempo of the attack slowed down and the initial fright wore away, I should expect to see a good many of the inhabitants of the B communities returning from the C cities and towns. A factor would be the miserable conditions prevailing in the C communities. Also, economic pressure would lead breadwinners to return even though they might leave their families behind. It would be at this stage that prior plans and institutional arrangements might be critical in getting the Nation back on its feet and into a fighting trim.

At this juncture the most important goal might be the restoration of employment, including employments in nonwar industry. To build up the volume of employment, however, a set of mechanisms would have to be provided to get employers back into action. The damage to our credit system would have been terrific.

By this time some of the shifts in military production mentioned earlier would begin to take hold and to create some new employment opportunities. Moreover, if defense production plans could be extended to the manufacture of goods needed for civilian supply, advance arrangements might be made with the makers of unneeded luxury goods to shift over to producing goods required by the displaced and homeless. Possibilities in this direction call for careful exploration but cannot be pursued here. In any event, for those civilian industries and distributors able to anticipate a continuing demand for their goods, the question of credit would be critical.

The Nation could not suddenly turn from a credit to a cash basis without a tremendous increase in working capital. On the other hand, the credit ratings of a great many businesses would be distorted beyond recognition. In fact, but for the moratorium, a great many corporations would clearly be insolvent. In these circumstances a Government instrumentality would be needed with the function of providing Government credit to induce suppliers to sell to manufacturers and distributors whose businesses were thought to be needed in the war economy. Doubtless this instrumentality could best be provided by the commercial banks, administering a streamlined form of Government guaranty. Obviously, however, no such system should have to be improvised after an atomic attack had begun.

The banking system—One of the most pressing problems after the period of initial shock would be to salvage the banking systems in the bombed areas, especially since these include most of the principal banking centers of the country. This seems to have been studied chiefly in terms of record keeping. That is a necessary part of a precautionary plan, but, given reasonably adequate banking records, where should accounts be administered and to what extent should they be honored? These are highly technical problems. Possibly the accounts of all banks in exposed metropolitan communities might be allocated in advance among the smaller banks of less exposed areas to which depositors should turn in event of attack.

The Government might guarantee every account up to the proportion of cash and governments held by each bombed bank and perhaps one-third of the balance not thus covered.

Needless to say, standby mechanisms should be designed to facilitate bank clearings in the post-attack period.

Corporate affairs — Enough corporations would lose their top officials and major shareholders to create legal problems in the management and ownership of corporations for which we are not now prepared. This is a problem that, with some Government stimulus, the members of my profession ought to be able to solve.

For many smaller business concerns some custodial arrangement would be needed, and I am not sure that the courts could assume the heavy burden of supervising receiverships. A special instrumentality is indicated.

Long-term contracts—The sudden change of expectations worked by atomic attack would knock the economic underpinning out from under many long-term contracts and leases. In many instances, *force majeure* clauses would provide escape hatches for the embarrassed party. However, it might often be better for the economy to forbid the complete dissolution of long-term contracts. Perhaps we might give our courts power to adjust the terms of a contract to the new situation and require its performance as thus adjusted, as was done in Germany and England during World War II. In many situations a thoughtful assessment of the hazards might lead to a mutual agreement in advance of the contingency that would be better than recourse to crowded courts after the event.

Landlords would be suffering from famines in some communities and feasts in others. In the crowded areas, rent control would have to be accompanied with power to billet refugees. Obviously, the administrative procedures ought to be worked out in advance. The taking of an inventory of potential accommodations would do a great deal to bring home to the American public the nature of the hazard they are confronting.

Insurance—The life-insurance companies would be up against a combination of heavy losses with severe damage to portfolios and a sharp falling off in premium income. Even though the losses might be so distributed as to permit most companies to survive, yet the state of their portfolios would make it important to relieve them of the obligation to pay all claims. One way would be to require the payment of claims up to 1,000 dollars in full and some fraction of all claims up to 5,000, leaving the rest for postwar adjustment. Another would be to relieve the insurance companies of all direct liability and substitute Government payments in the place of insurance policies.

The facilities of our courts would be strained in making the determinations necessary in settling many insurance claims. The whole problem of judicial jurisdiction and procedures requires examination in greater detail than is possible here.

Government Compensation

There will be three categories of claimants for direct Government payments. First, the injured, many of whom will have to be taken care of in the vicinity of class A cities by Government medical agencies. Others can better be distributed to less-burdened communities and paid money allowances.

A second category of claimants for relief will be those who have been deprived of breadwinners by death or injury. At first they will have to be given relief in kind, but they should be shifted over to a cash allowance and moved into class D areas.

The third category would comprise the unemployed whose number would be substantial in all areas, and vast in some. For a time at least unemployment compensation would provide a mode of taking care of such persons, but, where mass migration had taken place, the inability to approve claims on the basis of local records would preclude recovery of compensation in regular course. Perhaps the only alternative would be a relief allowance.

Property damage would not be compensated by ordinary insurance since war risks are excluded. Should the Government substitute its own war-risk insurance system? This could be done as it was during the last war but on a vastly larger scale.

An alternative way of handling the matter was proposed in the War Disaster Bill of 1951, the only Government plan I have seen proposed to meet this problem.

The alternative of the War Disaster Bill strikes me as perhaps the wiser approach, but the problem needs more study.

Transportation and Utilities

Obviously the transportation problem would be a major one. In the areas of potential damage, a taking over by the Government would be hard to escape and in such areas the commandeering of trucks and even private passenger autos might be essential. Plans for this could not be worked out in detail in advance, but, as in so many instances, the selection of personnel and the granting of of essential authority would make the response to the challenge much prompter and more effective.

One practical difficulty would be to provide gasoline to keep automobiles rolling.

Electric utilities would have to be administered as closely coordinated systems in order that needs previously supplied by the large urban generators in the bombed cities could be replaced by current from undamaged stations.

The Postwar Period

It is hard to see how an atomic war could last a long time. Possibly the means for conducting atomic war would be exhausted on both sides before the will to fight had ended. Probably the capacity to fight would have been reduced by then to a point where no large-scale demands would be made of either economy.

Undoubtedly, war of the sort postulated would leave the United States in an economically crippled condition, but the experience of Germany, Japan and Russia testifies to the recuperative powers of a war-damaged economy. The better the economic and social structure that had been held together during the conflict, the sounder and more rapid the process of restoration. However, I think it is fruitless to hope that a substantial inflation could be avoided, particularly if the Government sought to equalize the damage sustained by citizens living in the bombed areas with that experienced by those who had only economic problems to cope with. The payment of compensation and the reconstruction of public services and facilities could not be met out of taxes and would certainly lead to printing-press money. Perhaps the worst danger in such a period would be the risk of the triumph of a demagogue. Again, the better ordered the society during the conflict, the less the hazard of this sort.

Much is to be gained by advance planning and at relatively little cost. The Government cannot afford longer to delay in calling on the public for its help. Once the public sees the problem as the problem of the entire nation and not merely of the areas exposed to bombing, as a business problem for every businessman and not simply as a problem of first aid and fire fighting, I believe that the public apathy now existing will come to an end.

BIOLOGICAL WARFARE

In an address (extracts of which are presented here) made on July 6, 1954 before the Rotary Club of Pine Bluff, Ark., location of the BW production development laboratories of the Chemical Corps.

Maj. Gen. William M. Creasy
Chief Chemical Officer, U. S. Army

States World War II developments have given BW a practicability it did not have before; BW bids for future recognition; has tactical as well as strategic application; communists would be likely to use it if to their advantage. He explains and stresses the necessity for a second-to-none preparedness in BW in the United States.—Editor

I consider it a privilege to be here and talk to you about a subject which should be of vital concern, not only to you, but to every thinking citizen of the United States. That subject is biological warfare. . .

Most of you here today probably remember the paper balloons released by the Japanese during World War II. When these balloons first descended in the United States, they were carefully examined for more than the incendiary material and explosives they were purported to carry. The Army was alerted to a graver responsibility and samples of the balloons and their cargoes were minutely analyzed by a new facility of the then Chemical Warefare Service.

It was the word of highly specialized technicians at this facility that reassured those entrusted with our national defense that a serious possibility had not materialized, that "the wind-wafted enemy objects had not brought a new and more insidious weapon to our shores."

This incident goes well to show how well prepared the United States was for the enemy introduction of biological warfare!

It was known that the Japanese had, since 1932, been actively interested in its possibilities. By 1937 they were operating research and testing facilities. . . .

BW Problem Given to Chemical Corps

In 1939, reports of under-cover activities in other countries caused the War Department to look into the situation. . . . In February 1942, it was reported that biological warfare "is regarded as distinctly feasible" and recommended that "steps be taken to formulate defensive and offensive measures." . . . The Chemical Corps . . . was asked, in November 1942, to take on this added duty.

Our operations in this field have been highly classified until quite recently. For obvious reasons, all phases of this work do not fall into the "Now-it-can-be-told" category. . .

As a basis for proper understanding of this subject, it is well to point out that World War II developments have given biological warfare a practicability it did not have before. Advent of the long-range bombing aircraft removes continental isolation, and the high degree of perfection of modern munitions now extends the battlefield to the civilian home front. . . .

Thus "BW"—the short term for biological warfare—which was only a threat in the last war, bids for future recognition. The restriction of armaments and heavy industry may induce nations to concentrate on new types of warfare. Biological warfare will not need tremendous industrial establishments. Further, it can be conducted under the guise of legitimate research, making detection extremely difficult. It must be noted that "BW" is a potential weapon whose capabilities remain unknown and unexplored except in a theoretical and philosophical sense. . . .

Biological warfare . . . is more than germ warfare or bacterial warfare. In adition to bacteria, it embraces the use of living organisms or their toxic products to cause death or illness in man, or damage to his crops and animals. Certain chemical compounds, while perhaps not true "BW" agents, are included as a matter of convenience. . . .

Concept of BW is Not New

Essentially, biological warfare is nothing more than public health and preventive medicine in reverse. Except for novel methods of achieving deliberate dissemination of pathogenic micro-organisms, it is a form of warfare which nature has waged against man for thousands of years, and against which our modern health practices have produced effective results. . . . Unlike the atomic or hydrogen bomb, "BW" is essentially anti-personnel in nature because it does not destroy buildings and machines, but is directed against man himself or his food supply—that is, his animals and crops.

The concept of this type of warfare is not new. Even with no help from man, germs have entered about every major military campaign. The crusaders at the gates of Jerusalem were cut down by the plague. The Moors in Spain were decimated by typhus, and every history student is familiar with Napoleon's Grand Army and how it was thinned by dysentery and spotted fever. Typhoid fever laid low more men than did bullets during the Boer War, and in the early days of World War II, malaria heavily attacked our own forces in the South Pacific. From scrub typhus alone, we suffered 6,685 casualties among American personnel in the South Pacific and Asiatic Theaters. This figure is about equal to one-third of an infantry division. Thus it is obvious that in many instances, germs, not generals, have decided the outcome of a conflict.

History has recorded that "BW" has been recognized and tried since time immemorial. There are recorded enough minor instances of its use to show that man has long recognized its value as a weapon. . . . .

In ancient times, the bodies of cholera and plague victims were hurled over the walls of beleagured cities with catapults, or left on the ground the enemy was expected to occupy, or used to poison waterpoints. History shows that blankets have been infested with smallpox virus and distributed among the enemy. . . .

These were the uses of "BW" in its crudest form, but they served the purpose of weakening the enemy by decimation of his manpower. . . . The Germans, in World War I, infected horses of the Rumanian Cavalry with glanders, an epizootic disease, and German saboteurs also infected horses and cattle in the United States intended for shipment to the Allies in Europe.

Biological warfare weapons are different from other kinds of weapons in that their results are generally delayed over a longer period of time, and it is difficult to

determine whether an outbreak of disease among men, animals or plants is the work of nature or man. Certainly, there is no real proof that it was used in World War II.

Various Effects Are Possible

To a considerable extent, the choice of biological warfare agent would be determined by strategic or tactical considerations. Thus, it would be possible to select for development into a weapon a lethal agent to bring quick death to human beings directly contaminated; a non-lethal agent producing a debilitating illness that would undermine the will of a nation to resist; organisms to decimate flocks and herds when scattered in the pastures and on grazing lands; or plant pathogens capable of seriously reducing the yield of staple crops. . . .

Despite many reports of isolated or small scale uses of "BW" contained in history, man has never attempted its use on a large scale . . . Strategically it might be possible to infect large segments of an industrial population with a lethal or debilitating biological agent and wait for its effect to be felt in the lessening of the production or other services vital to the war effort; its effect at the front may not be felt for weeks or even months. This is true of most forms of strategic attack. Possible tactical applications of this weapons system must not be overlooked, however.

If we consider tactics on a grand scale rather than merely the maneuverings of closely engaged units, we can find use for highly virulent BW agents even if we must wait several days or weeks for their effects to be felt. . . . It takes weeks to build up forces for a major effort, and located opponent forces may be infected in advance so that they will be out of the fight regardless of their location when the attack is launched.

The kind of agent which might be used in biological warfare would depend on what the enemy hoped to get out of an attack. If he wanted to kill large numbers of people he might use plague, typhus, cholera, small pox or some similar disease. But an attacker might only want to make people sick rather than to kill them. That woud cripple both fighting and production forces. It also would tie up doctors and hospitals. For this purpose, diseases like rabbit fever and undulant fever might be used.

There are also many diseases that could be used to attack the different kinds of animals upon which many depend for both food and clothing. Anthrax is one example, Glanders is another. Many kinds of plant plagues and pests could be used to attack food crops. . . .

Specially prepared chemicals might be used in raids on growing crops. At the same time, in preparing ourselves in these fields, vigorous research continues to insure that our defensive measures against such attacks are in proper shape. Much progress has been made.

The kinds and effects of biological agents that might be used are well-known to scientists. In this regard, let me disabuse your minds concerning new "Mystery Germs and Poisons." During the past few years a great deal of foolish talk has been heard about supposedly new types of germs and poisons so powerful that even a thimblefull could kill millions and millions of people. Most of this is scare talk built on twisted facts, and is not consistent with the truth.

Progress in Detection Technique

Coming now to the field of defensive biological warfare, the problem of rapid detection and identification is one of the most important and perhaps the most difficult. Micro-organisms and their toxic products cannot be detected by any of the senses and conventional methods of plating and incubation are much too lengthly. However, a . . . significant step toward early detection was the development of a revolutionary detection device around which a workable defense can be built. It is a very thin filter which will trap bacteria, permitting them to be identified within 15 hours, or one-sixth of the time previously required.

In the area of protection against biological agents, there are two general methods. First, there is biological protection, involving the use of immunizing toxoids, vaccines and antibiotics; and and second, mechanical protection of individuals and buildings. In this connection, you may be interested in the fact that shortly before the Normandy Invasion, the Intelligence people advised that the Germans were preparing to use Botulinus, an extremely powerful toxin, against Allied troops. Several million doses of toxoid were flown to England for immunization of our troops; however, the mass immunization was not undertaken, nor did the Germans use the agent. We are, of course, working progressively to develop immunizing techniques against all potential agents, one of the most interesting facets of this field being the production of vaccines which are effective against two or more diseases.

Mechanical protection against biological warfare is quite similar to that against chemical warfare, and efficient items for individual and collective protection are available. For decontamination of "BW" agents, choloride of lime which is used against chemical agents, is quite effective. . . .

Let me digress here for a moment to ask a question: would the communists be likely to use biological warfare if it would benefit their cause in the slightest degree? The answer, I'm sure you'll agree, is a forcible "yes."

(Continued on page 32)

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THE CIVIL DEFENSE EVACUATION PROGRAM

By Colonel William A. Brewer
Director, Tactical Operations Office
Federal Civil Defense Administration

(New concepts in this age of peril including prospect of more warning time in the case of air attack have brought a switch in Civil Defense thinking from emphasis on protective shelters to the idea of temporary evacuation of target cities. In this article, Col. Brewer, chief civil defense tactician at Federal Civil Defense headquarters, undertakes to explain for Journal readers this new doctrine and answer various questions which have been raised as to the feasibility of evacuation.—Editor)



COL. WILLIAM A. BREWER

Colonel William A. Brewer, U.S. Army Reserve, born in San Francisco, was graduated from the University of California in 1920. He served in the Office of Civil Defense during World War II from 1941 to 1944, first as Deputy and later as Chief of Training. Thereafter he served for two years in Europe on the staffs of General Patton and General Bradley in connection with the handling of displaced persons, liberated concentration camps and public and private charity and welfare matters within the responsibility of the U.S. Forces in Germany.

"Dig, die, or don't be there!" Those, in popular language, are the three alternatives open to people in modern cities under the threat of attack by nuclear weapons. And of the three, the advice of the Government is the third—"Don't be there!" Val Peterson, the Administrator of FCDA, has enunciated this policy, on recommendation of the National Security Council and with the approval of the President, who called it "a new concept of civil defense." It is integrated, especially in its warning aspects, with the total program of continental defense. And the Federal Civil Defense Administration is working actively with the States and cities to assist them in the practical mechanics of rapid, successful temporary dispersal of their populations, to be implemented as soon as sufficient warning time becomes available.

That, in a nutshell, is the substance of the dispersal story, as it stands today. While there has been exhaustive debate on the feasibility of the plan, responsible FCDA officials feel that this is healthy; and the practical tests made in Spokane and Bremerton, Washington, and Mobile, Alabama, have demonstrated beyond cavil its practical possibilities.

In the early days of civil defense, when estimates of enemy capabilities ran to only a few atomic weapons and when there was no expectation of more than a few minutes of warning time at best, it made good sense to say, as the then Administrator of FCDA did, "We will not take to the hills." At that time, it was at least a theoretical possibility, also, that an enemy could, by merely flying a decoy plane at the extremity of the then warning net, keep the country in a state of alert so that industrial production would be interrupted or non-existent. However, both of these conditions have changed.

It is no secret that today hostile capability is vastly increased over that of three or four years ago—both as to size of weapons of the advanced type and as to the number he has available. And neither is it a secret that our capacity for "instant massive retaliation" has increased. Thus, not only is the number of cities that might be attacked in a first strike very largely increased, but also the probability that any provocative feint in the direction of this country might release the forces of "instant massive retaliation." This, of course, would be a command decision—but it is safe to assume that the intelligence available to the commander making it would be far more complete and far more detailed as to the type and status of planes picked up by the warning mechanisms.

Further, it is perfectly sound to believe that an enemy knows this, and would think twice, or more, before undertaking a feint, lest he trigger off something he would not welcome.

As to enemy capabilities, it is an unclassified fact that FCDA's national "Operation Alert," on June 14 and 15, 1954, used an attack pattern of atomic strikes on 41 United States cities as the basis of the problem. An attack of anything approaching that order of magnitude is a very different thing from an attack on two or three cities. And such an attack pattern would increase the probability of being in an attacked area, for any one individual, by many times.

These are among the many considerations which led FCDA, in January 1954, to issue its now-famous Advisory Bulletin No. 158, to State and city Civil Defense Directors, in which its future policy was outlined, along with specific recommendations of steps to be taken now. This document may and probably will prove to have lasting fame as a milestone in saving the lives of millions of Americans, should we have an actual outbreak of a third World War. Its issuance followed many months of careful study and painstaking staff work, not only within FCDA but in the National Security Council and with other agencies affected; and, as has been said above, its integration into the total plan of continental defense. The

first staff studies were begun in November 1951, and completed the following January. Further studies were made through 1952, and the detailed work was done in the spring, summer and fall of 1953. Thus it can be seen that the decision was not a hasty one.

Dispersal Capabilities and Warning Time

The amount of warning time we can count on, with an acceptably small proportion of risk, is closely related to our ability to disperse satisfactorily. As it stands, there is doubt as to whether many of our coastal and border cities can today count on enough warning time to make dispersal an immediately practical thing. However, this situation is rapidly changing. Many interior cities and some of the coastal or border ones are able to disperse now. FCDA Administrator Val Peterson has been outspoken in urging that all cities start their dispersal studies and planning now, and that those which can do so put their dispersal plans into effect without delay.

Improvement of our ability to spot and track hostile planes headed toward the United States, and to predict their probable destinations is the job of the U. S. Air Force. In order to transmit the warnings originating from their procedures to the States and cities, FCDA maintains a large-scale warning network, stretching from the Air Force installations where the warnings are given to some 200 "Key Warning Points." From these "Key Points," the warnings are fanned out under State authority to over 3000 sub-key points. If necessary, the sub-key points can be alerted and warned, throughout the United States, in less than two minutes. The Civil Defense Air Warning Network is constantly being expanded and improved.

The Ground Observer Corps, trained and operated by the Air Force but recruited and administered by State Civil Defense organizations, exists to provide low-altitude surveillance. As such it is a complement to radar. The two make up the aircraft detection system. The Air Force, of course, is responsible for aid defense—detection, identification, interception and destruction of hostile aircraft. It does not seem possible to expect that in the case of massive formations, air defense combat forces will be entirely successful. Therefore, we must anticipate that a number of planes from a large mission would be able to get through and drop their bombs on United States cities.

Part of the integration of civil defense dispersal policy into the system of continental defense rests on this relationship with warning time. Secretary of Defense Wilson testified in a recent session of a House Appropriations Subcommittee as to progress being made in the installation and perfection of our warning system. Among other things, he indicated that close to 10 percent of military spending for the current fiscal year would be earmarked for continental defense, including the cost of anti-aircraft battalions, radar stations, interceptor squadrons, and other defensive units. In a joint statement announced by Secretary Wilson and his Canadian counterpart, Brooke Claxton, it was disclosed that preliminary work on a "distant early warning" radar fence was well advanced. This system is designed to give six hours notice of an approaching attack on the United States.

The net of all this, of course, is that as our warning system is improved, the ability of our cities to make emergency dispersal is improved. Thus, each day brings us closer to our objective of avoiding casualties and maintaining our ability to fight back. And in this sense, each day improves our ability to turn back and to make fruitless an enemy attack. It is not too much to hope that at some future time the reward of such an attack might be so reduced as to discourage or at least delay its actual launching—but that time still seems to be a long way off.

How Cities Can Disperse

No one thinks that the movement of the population of a large city to safer areas would be easy or simple. As one FCDA tactical planner expresses it, "It's a pocket full of fish-hooks." Anyone who has ever gotten even a small family launched on a trip to the country knows how many details must be seen to, how much inertia of normal habit must be overcome, to accomplish such a move; and yet the fact remains that families by the million do make such trips—frequently and successfully. Very much the same thing is true of civil defense dispersal.

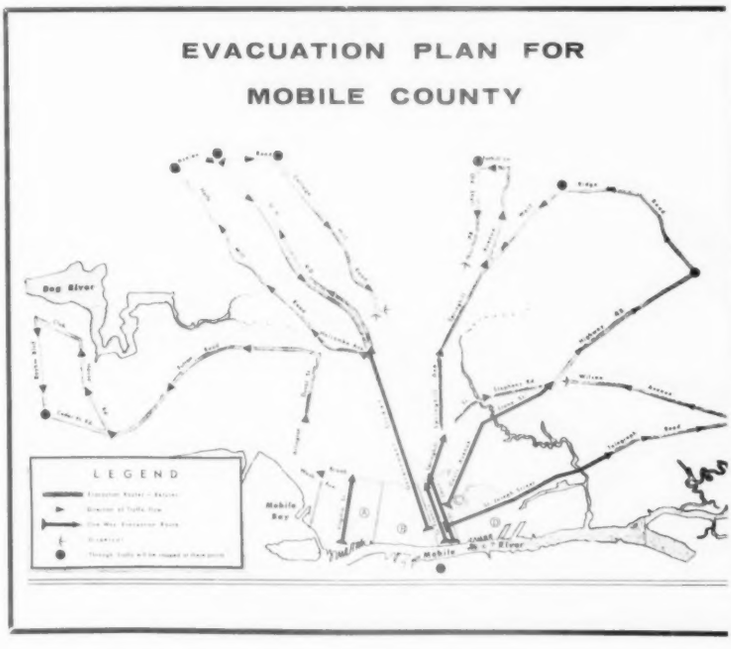
For the curious thing is that most cities already do accomplish quite a substantial dispersal every evening between 4:30 and 6:00 p.m. or thereabouts. For example, when the heads of Chicago's Civil Defense organization studied the question, they found that the population of the one-square-mile loop, at 4:30 p.m., is over 900,000—but that, an hour and a half later, it is 85,000. The civil defense authorities of Chicago, Director Anthony F. Mullaney and Co-director Victor C. P. Dreiske, have stated that in the light of these figures, their problem is not whether to disperse or not, but rather, how much dispersal can be accomplished with the warning time that can be expected.

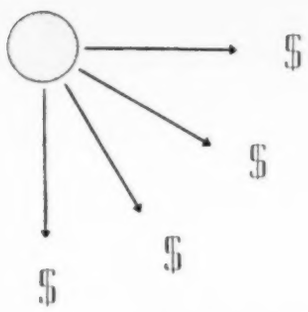
The same order of dispersal, day by day, is accomplished in many other cities: for example, the downtown zone of San Francisco has a peak day population of 589,000, which declines in little more than an hour to 65,000. And this everyday dispersal is accomplished without the spur of emergency, and with cross-traffic and counter-traffic permitted.

The FCDA Advisory Bulletin, No. 158, points up a number of special problems for which direct preparations must be made. Those needing assistance, such as the aged, handicapped, school children and hospital patients, constitute a problem for special planning and attention; so does the question of securing immediate control of traffic, the reversal of traffic entering the city. Education of the public, to establish the fact that if a

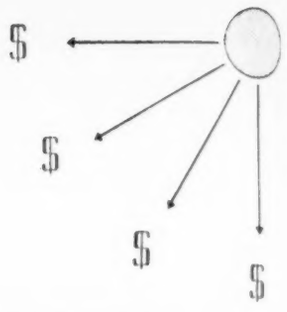
(Continued on page 25)

This chart (here greatly reduced in size) accompanied by detailed map of the areas A, B, C and D of the city of Mobile, Ala., was prepared in connection with the evacuation plans of the Mobile County Civil Defense Authority. It was furnished by FCDA as illustrating evacuating planning. It is noteworthy that such plans provide that persons not having previously arranged transportation will walk in designated directions until picked up by motor vehicle.





MONEY • SAVING ATOMIC SIGNALS



INDUSTRIAL USES OF RADIOISOTOPES

JOSEPH CAMPBELL
Member of the U. S. Atomic Energy Commission

Speaking at Rutgers University, New Brunswick, N. J., July 21, 1954, on "Industrial Applications of Atomic Energy,"* stated that these uses already mean a saving of $100,000,000 a year and place us on the "threshold of a new frontier."

IN discussing the Civil War, Walt Whitman once said, "The real war will never get in the books." There are times, as I sit in the Atomic Energy Commission building in Washington, D. C., when I wonder whether the real story of atomic energy will ever "get in the books."

There are exciting and dramatic aspects of atomic energy which are natural-born headline grabbers. "*Hydrogen Bomb Can Destroy Entire City*" is a sure-fire attraction, especially when accompanied by lurid descriptions of the effects of the weapon and imaginary illustrations of the rubble and ruin caused by the explosion.

A news story which states "*Atomic Reactors to Produce Unlimited Power in the Near Future*" is always good for the front-page. People are excited by glowing descriptions of how the deserts may be watered and the dark places of the world lighted by the application of this new energy.

As I talk to you tonight I do not mean to minimize the fact that the primary business of the Atomic Energy Commission is the development and production of a family of nuclear weapons for the protection of the United States and the free world; I will not attempt to play-down the emphasis which we are placing on the effort to develop nuclear reactors which may ultimately produce electrical energy competitive with conventional fuels.

New Tool of Research

But there is an intriguing thought that occurs to me, from time to time. The more I look into it, the more fascinating it appears. It is not dramatic. It is not alarming. It is not sensational, but perhaps it bears the same relationship to the development of our economy as plain common red bricks bear to the magnificent buildings which are their ultimate product.

Through experimentation and research we have discovered that all of the atoms of any particular substance are not identical. They may be the same chemically and physically, but insofar as their nuclear construction is concerned, they are slightly different. This slight difference between the various atoms of the same substance is of tremendous importance since some of them are "unstable," that is to say they emit small amounts of energy in the form of radiation at precise intervals. We have learned that by exposing some atoms to intense radiation we can create other unstable atoms not found in nature. The energy emanating from these atoms can be followed, detected and measured wherever it occurs and as a consequence we now have a research tool of incalculable value.

Without complicating my remarks too much, in essence we have discovered a means whereby we can take atoms of ordinary material, such as sodium, and turn them into little radio stations which send out signals which in turn can be accurately measured by a very simple device. We can, therefore, "tag" a minute quality of material and follow it wherever it may go in meal, in



Harris & Ewing photo.

JOSEPH CAMPBELL

Mr. Campbell was appointed a member of the United States Atomic Energy Commission in July 1953. Born in New York City March 25, 1900, he attended Columbia University 1919-1924. He served in the Army in World War I, September to December 1918, receiving his discharge following the Armistice. His extensive business and professional career includes associations with the Trustees of Columbia University as Assistant Treasurer from May 1941 to March 1949 and as Treasurer and Vice President from March and June 1949, respectively, to date (on leave since July 27, 1953); duty as chairman of the Negotiating Committee, BNL Contracts, Manhattan Engineer District in 1946, and other committee or commission connections with the Department of Defense. Mr. Campbell is a Certified Public Accountant.

*The address of Mr. Campbell released for publication by the AEC is presented here in full except for some contraction as indicated in the text—Ed.

fluids, or in the human body. We have put a scientific bell on the atom sheep which enables us to follow the flock. These so-called "*radioisotopes*" have two properties —precise identification and detectability from a distance —which in my opinion make their use limited only by man's ingenuity and his resourcefulness.

Growth of Rad-Detection Industry

The significance of this scientific discovery relating to radioisotopes is now beginning to be realized in the industrial economy of our nation. In 1946, just eight brief years ago, there were less than 200 people employed in the manufacture of instruments for the detection of radiation. At the close of the year 1952 there were 75 instrument companies at work in this field, employing over 2,500 people and doing a gross business of about $20,000,000 a year. The growth in 1953 has been equally astonishing and our best estimate is that by 1956 this entirely new industry will report sales amounting to upwards of $35,000,000 annually.

Now if people are making instruments, it must be because they have customers who are willing to buy them. Let us examine briefly who these customers are and what they are doing in industry with the "tagged atom."

In the United States today there are 860 industrial users of radioisotopes. In this state of New Jersey there are 40 companies which have found that the atom can improve their product, lower their costs and increase their profits. Here in New Brunswick, New Jersey, there are two important companies which purchase and use radioisotopes in their normal commercial operation. It may be slightly dramatic to point out to you that prior to 1946 the commercial distribution of radioisotopes did not exist, yet by May 31, 1954, the Atomic Energy Commission had made 47,566 shipments to 2,139 users of radioisotopes in the United States and 2,743 shipments to 53 foreign countries.

Fascination and Money Too

How can money be made out of the fact that atoms send out signals which can be detected on instruments? This is the fascinating part of the whole business. Here is where American ingenuity may eventually finance a portion of our whole atomic energy program. Let us examine some specific cases:

1. Radiographic Inspection. One of the problems in the casting and welding of metals is the detection of flaws, the presence of which might cause serious breakdowns or actual loss of life. I am certain that every member of this audience is comforted by the realization that the welding which fastens together the various parts of an aircraft in which we travel is not in any way defective. Sometimes so much depends on such small things as a weldment or a casting.

If fabricators of metal could afford X-ray machines or radium, they could detect these flaws, but the type of equipment necessary is generally far too cumbersome and expensive for normal industrial use. With the radioisotope, cobalt-60, however, a capsule weighing less than an ounce and no bigger than the eraser on the end of a lead pencil may be placed on one side of the material to be inspected and a photographic film on the other. After an exposure to the signals or radiation from the radioisotope, the developed film will indicate any defects in the metal. For $50 an industrial concern can buy an amount of cobalt-60 which corresponds, in effect, to a similar amount of radium worth $25,000. Furthermore, the amount of radioisotope, cobalt-60, now used for radiographic inspection by industrial concerns, far exceeds the total amount of radium estimated to be available in the entire world. Cobalt-60 can be manufactured by the Atomic Energy Commission contractors in unlimited quantities, depending upon the market which is now available or which will be developed in the future.

In addition to the safety factor there is a real dollar saving in radiographic inspection. It is a matter of record that the American Society of Mechanical Engineers recognizes the advantages of radiographic inspection and accordingly their codes permit use of a twelve percent thinner boiler plate for pressure vessels. The use of radiographic inspection in the so-called Horton sphere which is a fifty-foot steel sphere for storage of high pressure gases results, on the average, in a saving of about $6,000 for each sphere. Considering that there are several thousand of these in use in the United States today, the cumulative saving is significant.

The perfection of this technique is no better illustrated than in the recently completed Atomic Submarine, the "Nautilus." The specifications for the welding in that ship required that the maximum leakage from any pipe be limited to one drop in 500 years. Only with radiographic inspection could such an extraordinary standard be achieved.

2. Thickness Gauges. One of the recurrent problems in industry has been that of accurately measuring the thickness of a coating laid over a base metal. In many industrial processes it is necessary to measure the thickness of gold plated over copper or that of tin over steel. The two previous methods in use were that of chemical analysis, which was time-consuming, and so-called transmission type gauges, which did not yield the desired accuracy of measurement. Both of these processes necessitated a periodic stopping of the production line so that the uniformity of the plating could be measured.

At the present time through the marvel of radioisotopes, a type of gauge has been developed known as the Radioisotope Backscatter Gauge. The principle is simple in that a radioisotope is enclosed in a sealed capsule with a thin window to permit the escape of radiation. When the electrons which are being emitted strike the metal or other material which is being plated, they bounce back and their intensity is counted. By recording this count on a simple meter, the thickness of the plating can be constantly observed without necessity for interruption of the production processes. This device has tremendous economic impact since there are thousands of companies in the United States engaged in plating processes. There are now 300 companies in the United States using radioisotope thickness gauges. Several large companies report savings up to $100,000 annually in the control of thickness of rubber, sheet steel, plastics, etc. It appears as though the average year-round savings of companies using these devices is the equivalent of two percent of the value of the production being measured. In an attempt to describe to you what could happen in this particular application alone, if we were to assume two percent savings in the quantity of copper sheet produced in the year of 1952, it would amount to a saving of about $9,000,000. It is estimated, by one consulting firm, that only five percent of the market for these radioisotope thickness gauges has been tapped. It is not too optimistic to anticipate that within the foreseeable future almost every production process, wherein one material is plated to another, will utilize some variation of this measuring instrument.

3. Use As Tracers.

A. *Pipeline Flow.* The usefulness of the two properties of radioisotopes, namely, that of precise identification and detectability, is demonstrated by their service to the oil industry. The costly pipelines that link our industrial

centers with the oil fields are used to carry many different petroleum products. At various places along the line there are switch points where the products are diverted. There are also interfaces which means merely the place at which various grades of oil, flowing through the pipeline, meet. It is essential that the operators of the pipeline know when one petroleum product is about to come to a switch point so that the proper valves can be opened at the proper time. It is estimated that about 50 barrels of oil were lost (at average cost of approximately $500) every time a change-over, from one grade of petroleum to another, was made. By adding the radioisotope Antimony-124 to each different type of oil in the pipeline and by attaching a Geiger counter to the outside of the pipe at the diversion point, the new type of oil automatically announces its arrival to the Geiger counter, and the operator has but to adjust the valve. Estimated savings by this process, which is now used by practically all pipeline carriers, run in the neighborhood of $500,000 a year.

B. *Leak Detection.* One of the ever-present problems in the maintenance of any system which carries water is the detection and location of leaks. One incident, which I hope never happens to any members of this audience, occurred in a ranch-type residence dwelling. It was heated by copper tubes, providing radiant heat, which were buried in the concrete floor. The fuel bill suddenly shot up to $400, a month and there could be no other conclusion but that there was a serious leak in the pipes. Instead of tearing up the whole concrete floor, a commercial laboratory added the radioisotope Iodine-131 to the water in the heating system. The floor area of the dwelling was explored with a Geiger counter and the position of the leak was located because of the large increase of radioactivity resulting from the gamma radiation in the water surrounding the leak. From this original application for the detection of leaks in enclosed systems, the principle has been expanded and is being applied industrially in many different places.

C. *Paint Mixing.* A problem which has confronted industry for many years is that of mixing two or more substances to form a uniform whole. Previously the only method available in the mixing of paints and pigments, for example, was to take periodic samples and subject them to laboratory analysis to see if the materials were uniformly distributed in the mixing vats.

Now, with the marvel of radioisotopes, an extremely small quantity of Manganese-54 can be added to the pigment and counters attached to the stirring paddles or other mixing device. When the radioactive output from each of the counters attached to the paddles is the same, the equal distribution of the pigment in the vehicle is proven and the mixing process can be stopped.

D. *Acidizing Oil Wells.* The rate of flow of an oil well depends, among other factors, on the porosity of the formation through which the oil flows. As the oil is pumped to the surface, particles of limestone are deposited in this formation. As the oil flow slackens, hydrochloric acid under pressure is forced down into the well to dissolve some of the limestone and to re-establish this flow. Various methods have been used in the past two decades to determine at just what depth the acid should be forced out. These methods have been time consuming, expensive and hazardous since there was the ever-present possibility that if the acid were forced out at the wrong level it might completely ruin the well. At the present time a small quantity of radioactive iodine is added to the hydrochloric acid and by the use of a Geiger counter the position of the acid in the well can be determined with great accuracy because of the rays which are emitted by the radioisotope and recorded on the counter. When the acid has been brought to the proper level, the pressure is equalized and the acid is forced into the right stratum. The savings which may eventually result from this new technique are at the present time incalculable.

As a Check on Washing Machines

The industrial applications of atomic energy, of which I have listed but a few, are innumerable. At the present time radioisotopes are used in density gauges, in the elimination of static electricity in the printing business, in the measurement of the wear of machine tools, and in many other ways. It may interest the housewives in this audience to know that the radioisotopes have invaded the dishwashing business and the automatic clothes washing machines. I imagine there are few women who have not been irritated by the inability of their dishwashing machines to remove egg yolk from the plates. Now, in testing, by adding a little radioactive material to the egg yolk and subjecting it to various dishwashing detergents, we have only to read the counter to determine the presence or absence of this national menace. Instead of just putting plain dirt on the clothing which the launderers are testing, we now impregnate the dirt with a little radioactive material and by taking the radioactive count before washing and after washing in a washing machine, we can, without question, accurately determine the efficiency of the machine and of the detergent being used.

At this point in my remarks I begin to feel like the young itinerate preacher who had just graduated from a divinity school and had been assigned as a circuit preacher. On his very first Sunday when he arrived at a small church in the ranch lands of the West, he was dismayed to find only one old cowpuncher in the church. Feeling embarrassed, he went to the cowpuncher and said, "Frankly, this is my first sermon, and since you are the only person here, I don't know whether to give my sermon or to ride on to the next town. What do you think?"

The sunburned old man replied, "Well, son, I don't know anything about preaching, all I know about is cattle. I reckon if I loaded up the hay wagon and went to the water hole to feed the cattle and found only one cow there, I reckon I would feed that cow."

The young preacher replied, "That's good enough for me," and he mounted the pulpit and for one solid hour he poured forth the four years of theology which he had learned in the divinity school. At the conclusion of his sermon, he again approached the old man and said, "Now, this is my first sermon and I would appreciate your frank comments and criticisms since it will be of help to me when I go to the next town." The old cowpuncher smiled and said, "Well, son, like I said, I don't know anything about preaching, all I know about is cattle. I reckon if I filled up the hay wagon and went down to feed the cattle, and I reckon if I found only one cow, I would feed that cow, but *I don't reckon I would give him the whole load.*"

I guess I had better take a lesson from the old cowpuncher and not try to give you the whole load about radioisotopes tonight. I have merely skimmed the surface of potential industrial applications. The medical applications are a field apart and are daily contributing to the eventual elemination of some diseases which have plagued mankind for centuries.

The agricultural applications are amazing. For the first time we may be on the road to discovering the secret of photosynthesis or how plants take sunshine and soil and convert it into material matter. We may be on the road toward the elimination of blights, rusts and other plant diseases which rob this economy of hundreds of millions of dollars a year.

Low-Cost X-Ray Machine

Despite my good intentions, I cannot resist displaying one example of medical application and one of agriculture. I have in my hand an extremely lightweight portable X-ray unit suitable for field use. It is three inches in diameter, six inches long and weighs approximately ten pounds. It contains radioactive thulium and was developed by the Argonne National Laboratory of the University of Chicago, a Commission operation, in conjunction with the Commission supported Ames Laboratory of Iowa State University, and is capable of diagnostic X-rays of remarkable efficiency. I display here to you one of the X-ray prints taken with this machine. The approximate cost of this machine which, produced in quantity, would be under $200, and, for certain purposes, it will do a job now requiring large machines worth tens of thousands of dollars. It is my opinion that before long this equipment will be available to the Armed Services, to the Rescue Squads of our communities, and to our physicians and will be a boon to mankind.

I now hold in my hand two potatoes which in themselves constitute a remarkable demonstration of a possibility of the use of radioactive material in the preservation of food. Both of these potatoes are two years old. The potato in my right hand was subjected to radiation which killed the enzymes in the potato which would have caused it to sprout. As a consequence, this potato is as firm and as fresh as the day it was removed from the soil. In my left hand is a potato from the same crop which was allowed to sprout and which is, of course, now unedible. Don't think for one minute we are trying to create radioactive "spuds" which will cause the consumer to glow in the dark. On the contrary, there will be no harmful radiation contained in the potatoes.

We are working in conjunction with various other Government agencies to determine how we can utilize the marvel of radioactivity in the preservation of food and the prevention of the bacterial growth which results in the spoilage of meat, canned goods, vegetables and other foodstuffs and the resultant loss of millions of dollars annually. I believe we will eventually overcome the remaining problems, and when we do, mankind throughout the world will benefit thereby. . .

(At this point Commissioner Campbell digressed to speak in appreciation of the interest and work of the Joint Committee on Atomic Energy of The Congress headed by Representative Sterling Cole (R-N.Y.) in furtherance of the basic peace-time use of atomic energy.)

Atom Uses Savings $100,000,000 a Year

I really believe that in applying atomic energy to industry, to medicine and to agriculture, we are on the threshold of a new frontier. I am going to give you the best estimate, or perhaps I should call it a "guesstimate" of what atomic energy now means to American industry. I believe the present savings, and *I emphasize present savings*, through the use of radioisotopes are in the order of $100,000,000 a year. My guess is that within the next ten years American industry will increase the savings to ten times the present value, or in the neighborhood of one billion dollars a year. This is the sort of vital, but nonsensational, progress that President Eisenhower referred to when he addressed a message to the "Atom for Peace" exhibit in Rome a few weeks ago, declaring:

> "We have only recently passed the mid-point of the Twentieth Century. I am convinced that history will one day record as the most far-reaching physical accomplishment of all this century—or even of twenty centuries—the discoveries which in recent years unlock, for the use of mankind, the boundless energy of the atom."

C.D. EVACUATION PROGRAM

(Continued from page 21)

person is inside the loading perimeter when the word to disperse is given, his best chance for survival is to walk to the nearest point on the loading perimeter and get a ride, is an essential.

In the latter connection, FCDA is reviewing the physical plans for warning the public, so that a third distinctive signal, the meaning of which is "start dispersal" can be added to the present "RED" and "WHITE" warnings. The public would be notified of this warning by appropriate uniform means, which through practice alerts and drills, will be thoroughly understood, recognizable, and effective in reaching all the people.

Upon such a dispersal signal, pre-arranged plans for movement out of areas of heavy concentration will go into effect. Most of the people in these areas would be able to move an average of two miles on foot in an hour or farther on wheels, assisted by a traffic control system worked out for the movement. Information on the emergency situation and protective steps to be taken would be continually furnished to the public via Conelrad radio, mobile units, and other available devices. Some type of shelter would be available en route for those who for various reasons are unable to proceed or must seek shelter en route when Warning Red sounds.

It is apparent that these plans can be made feasible only on the basis of thorough individual urban analyses and other studies, and FCDA has been urging the appropriate authorities to give high priority to such analyses in principal cities of the critical target areas.

Measurable progress is noted in all stages from "plans under consideration" to actual machinery for repeat evacuation drills. Larger metropolitan centers are conducting comprehensive studies with traffic experts to devise and perfect practical evacuation programs.

In those cities where planned evacuation drills have been completed, civil defense officials and impartial observers, upon preliminary evaluation of the exercise, are in agreement that with careful planning and practice, evacuation will work.

It is vital to the security of our nation and the lives of millions of people that, whatever the cost and regardless of the difficulties and obstacles to be overcome, evacuation must work. If the progress made to date continues, it *will* work.

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INDUSTRIAL DEFENSE

Conference Conducted by the Chamber of Commerce of the United States

THE Chamber of Commerce of the United States conducted a full day's conference in Washington, D. C., June 15, last on "Industrial Defense in the Atomic Age."

Members of the Armed Forces Chemical Association, a number of whom were among the 250 business and industrial executives present, could well regard the program as one carrying forward and amplifying the symposium on "Disaster Planning" at the annual meeting of the Association in Washington last May.

In opening remarks, Mr. Clem D. Johnston, President of the Chamber, noted that this vital subject is to be followed up by the Chamber with additional studies or presentations. A full report of the various sessions over which Maj. Gen. Otto Nelson, USA, Retired, Vice-President of the New York Life Insurance Co., presided, is available to members of the Chamber on application, price $1.00.

As have other studies on this subject, this conference brought out the necessity for advance planning by industry in order to be able to cope with sudden disaster situations and the fact that industry probably would have to rely largely on its own resources for disaster relief services at manufacturing plants.

The meeting also brought out the fact that defense in the Atomic Age accentuates considerations outside the field of military responsibility and which are not included either in the functions, as they generally are understood, of a Civil Defense organization.

Non-Military Defense Considerations

Among these considerations in planning to cope with sudden disaster of vast magnitude are special problems in the economic field such as the stockpiling, distribution and control of currency, provisions for credits, and problems pertaining to insurance. Also, among such considerations are utilization and distribution of manpower and problems in the area of health and education. Such matters, it was brought out, are within the cognizance of the Office of Defense Mobilization.

Lt. Gen. Willard S. Paul, USA, Retired, who heads up the non-military defense organization in ODM, alluded to these subjects in his address before the gathering. He emphasized particularly, however, the effort of his organization to promote defense by lessening the vulnerability of the industrial structure of the country through measures for dispersion and protection of manufacturing installations. In promoting industrial dispersion he pointed out that in this way it could be made far more difficult and costly for an attacker to destroy facilities essential to our defense effort. "By this we do not mean," he said, "we should uproot our established factories and move them out in the desert. We do recommend that new industries locate at least ten miles from the boundary of a target zone to obtain relative safety and still meet economic requirements."

In line with the thinking were the remarks of Mr. Arthur Fleming, the Director of ODM, who was the guest speaker of the conference at luncheon at the Mayflower Hotel. Mr. Fleming said that in the case of a company which is considering removal of a plant to a new location where it will be less subject to damage or destruction in the event of an attack on the country, ODM stands ready to discuss the matter of tax amortization in connection with the cost of relocation that would be involved.

Soviet Technological Capabilities

The Honorable Donald A. Quarles, Asst. Secretary of Defense (Research & Development), spoke on the communist menace and the significance of current technological developments in weapons and aircraft.

Referring to Soviet Communism he said, "It is a menace that goes beyond the military threat. In its moral and spiritual aspects it seeks to destroy our way of life. . . . The Soviet menace goes far beyond the ambition of a single ruler. They are planning for an entire historical era."

As to Soviet capability in the atomic field, Mr. Quarles observed that it has been revealed that the powerful explosion in the USSR in August, 1953, was produced by a weapon, or a weapon prototype, which derived a part of its force from fusion. With respect to the Russians' capability in aviation he noted that they have 1,000 TU-4 bombers, copies of our B-29's; that in their all-jet air show over Moscow this year they included new medium jet bombers comparable in size and design to our B-47; and, "even more significant," they displayed for the first time a heavy jet bomber comparable in appearance to our B-52.

"These new bombers," he said, "gives a real increase to the Communist capability of attack, especially against targets in the United States."

Secretary Quarles stated that the Russians had access to German war time developments in the field of guided missiles and have shown much interest in the development of submarines. "Would it not be prudent to assume they have some capabilities in this area?" he asked. He said we could be in error if we tried to predict the exact timing of their work and the range and power of their weapons, but, he added, "In this speculation we must not rule out the possibility, at some future date, of intercontinental missiles."

Remarks on Technical Manpower

With respect to the Soviet technical manpower, Secretary Quarles said, in part:

"Since we have touched on the long-time aspects of the situation, I would like to point out some of the basic factors which I think are important. As you are well aware, this is a technological era. Our enjoyment of our freedoms in America and our strength for security stem to a large degree from our technological superiority. . . . Since the beginning of World War II, we have been experiencing a serious shortage of scientific and engineering talent.

"Now let's look at the competition. In the USSR the leaders have long regarded science and technology as the key to the attainment of their goals. They have developed

large programs for scientific and technical education. Since 1918, the USSR has had a tenfold increase in the number of institutions and the number of students in higher education. In this country during the same period we doubled our total students. Quantitatively, they are now graduating more scientists and engineers than we are. Although we still have a larger total number, they will not be long at catching up if the present rates are maintained. This is a real challenge, both to us in government and to you in industry."

In regard to air defense, Secretary Quarles said a word of caution is necessary in thinking about what can be expected of an air defense system.

"An impenetrable wall is so attractive," he said, "that we are likely to be trapped by a Maginot Line philosophy here. There is no absolute air defense system in the international chess game of technological move and countermove. Furthermore, such a system, in itself, would never be an absolute deterrent to an enemy who risks only his striking aircraft in attempting penetration. Our primary dependence will be on offensive power to destroy the power of the enemy, his industry, and his forces in being. As a counterpart to this offensive strength we must continue to make every reasonable effort to achieve a sound air defense in being and a sound program for its continuing improvement."

With respect to our joint planning with Canada on air defenses, Secretary Quarles commented on the "completely co-operative and constructive attitudes" he had found in a recent visit to Canada he had made.

"How to Lose a Short War"

The Honorable Val Peterson, Federal Civil Defense Administrator, speaking on "The H-Bomb and American Industry," opened with a statement that he would tell how to lose a short war. "To lose a short war," he said, "you lose enough productive people and plants—quickly enough—to demoralize the rest of the nation's defense production and destroy the nation's will to resist." He put forward the idea that to insure war-winning morale among workmen in essential industry, it is necessary for industry to adopt special measures for the security and well being of the workers and their families.

In this connection he continued: "Germany lost the war as much through failure of civilian morale, as through lack of machines or military manpower. So did Japan. Modern wars are not lost solely by armies in the field. They are also defaulted by the essential workman who has been forced to surrender too much that is near and dear to him. . . ."

Charles F. Honeywell, Administrator of the Business and Defense Services Administration, U. S. Department of Commerce, told of the work of his office in the field of industrial defense, and stated that the 25 divisions of his administration are ready to assist Company managements of defense industry with preparation of their Company plans and in the solution of their industrial defense problems.

Mr. Honeywell in his address referred specifically to the presentation to be made by the final speaker, Mr. John A. Redmond of the Koppers Company, Inc., describing a specific company defense plan. Mr. Redmond's address is presented separately herein.

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WHY A PLAN FOR EMERGENCY AND DISASTER

By JOHN H. REDMOND

Assistant Production Manager
The Koppers Company, Inc.
Pittsburgh, Pa.

(Slightly condensed, there is presented here as of probable interest to many Journal readers, the address at the Industrial Defense Conference sponsored by the Chamber of Commerce of the United States in Washington, June 15, which describes disaster defense measures adopted by a specific industrial concern.—Editor)

THE problem discussed today by these most capable speakers has grown up in our thinking and our minds as a wartime problem—something that will happen only in wartime—and even then it won't happen to us but to the "other fellow."

We in industry know that disaster can strike any time—and whenever it strikes the time is not a convenient one.

You all undoubtedly remember the tornado which struck the Norton Company plant in Worcester, Massachusetts. You may recall that in a matter of seconds, the wind tore off 80% of the plant's roof, removed most of the glass and transite siding, and turned the cafeteria into a "pile of rubble."

Fortunately, no lives were lost and there were only eight injured. The Norton Company had what they believed was an effective disaster control set-up. In their opinion, it proved 90% effective for this peacetime disaster.

But they learned these things:

Organization

Personnel to handle any disaster plan must be assigned and trained well in advance.

One man must head the program and make all decisions.

He must have an equipped location from which to work.

Any plan must include provision for rehabilitating your plant and care of the injured.

Self-Sufficiency

When disaster strikes a community, such services as fire department, police department, and medical aid are not available. They are either busy or can't get to you because of blocked or jammed roads.

You must be able to go ahead on your own.

Training

It takes rehearsals, training, and retraining to keep the program in good working order.



MR. JOHN H. REDMOND

Mr. John H. Redmond, the author, was born July 24, 1912, in Columbus, Ohio. He was graduated from Ohio State University with a degree of Bachelor of Mechanical Engineering, and spent one year in post graduate work in Works Management with the Westinghouse Electric Corporation.

In World War II he served as a contracting and inspection officer in an Ordnance Procurement District. Entering service as a First Lieutenant in 1940, he was discharged in 1946 in the grade of Colonel.

In his present position as Assistant Production Manager, Koppers Company, Inc., Mr. Redmond's responsibilities include those of Company Security Officer.

Immediate Steps in Disaster

Evacuate the plant immediately. Danger from live wires, utilities, falling objects, cannot be over emphasized.

Have men available to handle power lines and other utilities and feed lines.

Cut down hazardous wreckage with torches. Rehibilitation cannot start until this is done.

Schedule work wisely. Men must be fed and they must have enough rest to avoid over-fatigue.

Concentrate your efforts on areas you want back in use first.

Emergency Equipment

You must have light. Emergency lighting equipment is needed.

Unusual quantities of items normally abundant are needed—rope, arm bands, safety pins, flashlights, safety helmets, safety belts, tarpaulins, slushing materials, special protective equipment (gas masks), and similar items.

Communications

Phones and P. A. system went dead.

2 way radio was needed.

A direct outside line is a must.

Identification

A positive identification system is a must. A card system is the best way of identifying workers permitted in the area.

Color-coding of repair specialists safety-helmets was the best way to identify them.

Customer Relations

Keep customers in other parts of United States correctly informed as to actual damage; wire-service reports are stometimes exaggerated.

The disaster which struck the Norton Company was only a peacetime disaster. . . . Now add to a disaster the conditions that would exist in event of enemy attack. We might reasonably expect these.

1. Widespread destruction.
2. Loss of life—even of some of your key personnel.
3. Anything from a few to many injured.
4. *No* outside help.
5. *No* time for planning—minutes to act. There will be 12-15 minutes between yellow alert and red attack signal.

All this adds up to one inescapable conclusion—the need and absolute necessity for as much planning and action for disaster control as is possible *before* disaster strikes.

Such a disaster plan needs to go beyond the worst type of peacetime disaster we might expect. . . .

A peacetime disaster plan is an excellent start . . . but a disaster plan for wartime must go further. Such a disaster plan must be based on the assumption that there will be at least partial success initially for any enemy, and, as a result, rather widespread destruction, disruption and chaos within our country and *within our industrial organiaztions.*

1. Such assumptions are not fanciful—they are realistic.
2. Some enemy planes will get through.
3. Some sabotage may be successful.
4. Some espionage agents will act.

At the time of the start of the Korean Incident, we in Koppers Company, Inc. reviewed our situation. We found we stood about like this:

1. We had a well organized safety plan for the Company. It was functioning well. There was a constant downward trend in our personnel injury frequency and severity. There was a downward trend in our first aid cases. We had improved the effectiveness of our fire protection and had trained fire brigades available as needed at our plants. At our chemical plants we had established and practiced emergency shutdown procedures.
2. We had developed an Industrial Mobilization Plan for our Company. . . . Under our Industrial Mobilization Plan we had proceeded with planning with the Armed Forces to the extent desired by them.
3. We had not gone far enough in these fields; in fact, had not acted in some of them to any extent. For example:
   a. Some of our plants had not developed procedures for rapid shutdown and evacuation. . . .
   b. No complete plan had been made for management succession in event of casualties. . . .
   c. Our provisions for safeguarding essential records, documents, technical know-how in the form of drawings and specifications . . . were inadequate.
   d. We had no organized plan for evacuating the injured.
   e. There were little or no provisions . . . for repair, and resumption of operations.
   f. There were no plans for handling of the dead.
   g. We had planned for disaster on at worst a plant scale—not on a nation-wide scale.
   h. Our plans depended heavily on outside help—municipal police and fire departments, normal sources of supply, doctors, and hospitals in the community . . . all sources which would be unable to help us to any extent.
   i. We had not developed as fully as we should the exchange of information with our industrial and community neighbors to find out what we had which could help them and what they had which could help us in time of need.
   j. The planning which we had done recognized time as a factor . . . but not as the factor of driving urgency it becomes in case of enemy attack.

Because of these findings we wrote our Defense Security Plan. Our plan is in five sections.

Sections 1, 2, and 3 contain general information and procedures. . . . (outlines) the objectives, policies, defense hazards as contemplated, and procedures for achieveing the objectives and implementing the policies. . . .

Section 4 deals with the protection of the Company Headquarters, our general offices located in the Koppers Building, Pittsburgh, Pennsylvania.

Section 5 outlines the measures to be taken in safeguarding the corporate interests of the Company should a catastrophe occur in the Pittsburgh Area which would disable the Koppers Building.

The objectives of the Koppers Company Plan are:

a. To safeguard the Company's facilities from enemy attack, espionage, and sabotage.
b. To insure uninterrupted operation of facilities considered vital. . . .
c. To establish physical security standards and procedures for certain designated facilities to meet the requirements of the Federal Government for defense contracts. . . .
d. To establish physical security standards and procedures for all other Company facilities . . . in accordance with local considerations and peculiar individual facility hazards.

As to our policies under the Plan, we have broken them into two groups: specific and general.

Our specific policies are:

The Company desires to meet the fullest degree its responsibilities to the Nation, to our stockholders, and to our employees in providing uninterrupted operations of vital activities of the Company. . . .

a. *Types of Security*, (Principal)
   First: Protection of each of the Company's facilities from enemy attack and sabotage to the degree required by location, nature of product, and other local consideration.
   Second: In addition to the above, certain designated facilities which have or are adaptable to defense contracts will also be protected against espionage.
b. *Defense Hazards*
   Protection from defense hazards can be accomplished by:
   1. An effective and practicable plan for the dispersal of designated activities and records.
   2. A workable plan coordinated with the local Civil Defense authorities whereby employees and tenants in the Koppers Building, on authorized

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warning, will be speedily evacuated to locations in the building where they will be protected from blast, flash and radiation. (This is now under review in the light of the more devastating effects of the H-Bomb).

3. A plan whereby the corporate interests of the Company will be safeguarded.
4. A plan for each of the Company plants for protection from enemy attack, espionage, and sabotage to the degree required.
5. A uniform procedure for security clearances of personnel who are to work on classified contracts.

Our general policies under our Plan are:

a. Safeguarding private industries is primarily the responsibility of civilian management; secondly, of local and state government; and finally, the Federal Government. . . .

b. . . . It must be emphasized that security plans must be made in advance, and certain parts implemented if we may expect any measure of success in combating the wave of sabotage immediately before or simultaneously with D-Day. *A high industrial security standard at the outbreak of a war may be a decisive factor in winning a war.*

c. If war should come, there is a strong probability that the enemy will attack vital industrial areas and in certain instances vital industrial facilities by air bombardment. It is the considered opinion of competent authorities that along with this air bombardment trained saboteurs previously infiltrated into key facilities will attempt to sabotage important war production and destroy valuable war supplies.

d. Effective security is a Company-wide job. Every employee has an interest in it because his *life* is at stake. . . .

e. While the primary purpose of the Company Defense Security Plan is set forth under the "Objectives" of the plan, it can be expected that valuable by-products may accrue to the facilities in the preparation of their respective defense security plans. (For example, the nature of the Company's products make a number of our facilities susceptible to fire and explosion. Now, generally speaking, these particular catastrophes just do not happen. They can to a large degree be controlled and in many instances can be prevented. Fundamentally, it can be argued that if we make detailed studies of our manufacturing processes from a security viewpoint, it may prove economical to alter some of our processes to make them safer, and in so doing eliminate costly protective equipment. In other words, in some cases we may find that safer processes and minimum ptrotective equipment may be the proper standards.)

We also had to make certain assumptions in preparing our Plan. These assumptions were:

General Assumptions

a. . . . An enemy attack would include the use of the Atomic or H Bomb with an air burst. This would appear to offer the most destructive effect. . . .

b. It is the general opinion of authorities . . . that large cities where industry is concentrated will be included in the first targets of an enemy atom or H Bomb attack. High explosive and incendiary bombs may be used on targets in more isolated areas.

c. The specific areas in cities listed for attack will be where there is heavy construction of industry and where there is heavy concentration of public utilities including railroad yards.

Specific Assumptions

Based on the above general assumptions we made these specific assumptions concerning company facilities.

a. Plants producing either raw material or finished products vital to the war effort and located in congested areas are the most vulnerable . . . and should receive first consideration in protection.

b. Decentralized plants producing material important for either the war or civilian economy, but located considerable distances from major target areas should receive consideration from the espionage and sabotage viewpoints, rather than from enemy attack.

c. With regard to plant protection, the position taken by the Company is that it is impracticable, if not impossible, to either bomb-proof equipment on a plant-wide scale or to construct elaborate bomb-proof shelters for all the employees of the plants. However, a great amount of protection can be afforded plant personnel by carefully planned use of best available existing shelter and taking advantage of information released resulting from current atom and H bomb tests. . . . Small personnel shelters for the plant protective force might be justified in certain plants.

d. The part to be played by camouflage and blackouts of our plants has been reduced by radar techniques. . . . For the time being, no provisions will be made for camouflage or blackouts.

As to procedures under the Plan:

The only absolute protection for industry in wartime is to go under-ground. However, the cost of doing so would be prohibitive. Therefore . . . we have attempted to balance cost against reasonable risk. For each facility of the Company, a determination is made by the respective Operating Divisions and the Company Security Officer of the type and degree of defense security measures required. In a number of our plants due to location and other factors, there will probably be no protective measures required.

In order to obtain maximum protection at reasonable cost and in the shortest time, a phased program has been placed in effect. The *first phase* consists of doing the most with what we have. It is a screening and training of personnel program with provisions for protection by utilizing existing shelters. The *second phase* deals largely with planning and recommendations from plants for additional protection. It is not planned to go much beyond the planning stage in this phase until the possibility of attack on any individual plant is more clearly defined than it is possible to define it now. The *third* and *final phase* of the plan deals with procedures in the event of a declaration of war by the United States.

That outlines the three phases of our program in gen-

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eral. You may be interested in a more detailed discussion of each phase.

a. *Phase I*

Procedures utilizing existing equipment and personnel. To be started immediately and carried to completion as soon as possible.

1. *Screening of Personnel.* For designated plants and when directed by separate communication from Company Headquarters, all applicants for employment and any doubtful employees designated by the plant management receive a security check. Instructions and necessary forms are furnished in separate communications by divisions to respective plants.
2. *The augmentation of the normal security organization by auxiliary personnel.* Such organizations have been strengthened as necessary for each local situation. Information on guard forces and instructions for first aid and firefighting against enemy attack have been issued to all plants.
3. *The training of above auxiliary plant personnel* . . . is being carried out in accordance with a training directive prepared by the Company Headquarters Industrial Relations Department.
4. *Psychological training of all employees* in connection with enemy attack has been initiated and carried out in accordance with a training directive . . . considered of importance in connection with panic prevention. It is contemplated that supervisors will instruct employees as to the exact procedures in the event of the yellow or red alerts.
5. *A training directive for supervisors and other key personnel on "Sabotage Prevention"* will be prepared and furnished selected plants. This will be in the nature of a training film.
6. *Emergency shutdown and restoration procedures will be established for all principal processes.*
7. *Close liaison will be established with local Civil Defense authorities* for reception of air raid warning signals . . . Periodic drills to test the communications of warnings should be held together with evacuation drills when designated by Civil Defense authorities.
8. *A shelter program utilizing existing shelter in the plant* should be initiated. Information concerning shelters from atomic attack has been furnished our plants. . . .
9. *Safeguarding the corporate interests* of the company in event of a major disaster. This includes a microfilming program of essential records and data; a reorganization point for use as an emergency company headquarters; *emergency reorganization and operating procedures;* and *a management succession plan.*

b. *Phase II*

Procedures requiring minor construction and procurement. To be started concurrently, if possible, or immediately after completion of Phase I. These procedures are to be planned only, and maintained in readiness for quick implementation.

1. A survey . . . of the plant to determine adequacy of existing personnel identification systems. Information on this has been distributed.
2. A survey to determine vital plant equipment and utilities requiring protection additional to that

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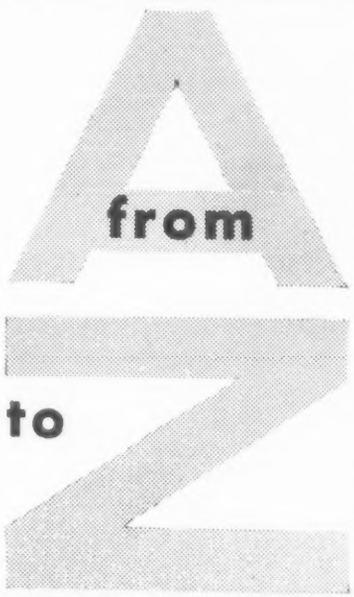
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furnished by the normal security plan. Information with respect to electrical detection equipment has been distributed . . . procurement and installation of such equipment . . . should not be initiated until approval by respective Operating Division Chief.

3. A plan for the construction and equipping of perimeter fire protection houses should be initiated.
4. Recommendations for the procurement of additional fire fighting equipment when considered necessary to place the Defense Security Plan in effect.
5. A plan looking toward the providing of auxiliary fire water should be prepared.
6. A plan for protection of Company equipment and tanks should be prepared and submitted to Company Headquarters.
7. Normal communications will undoubtedly fail under attack. . . . Accordingly, an alternate communication system should be planned. This should include some form of radio transmission, and also ample messenger service from control room to vital points in plant.
8. A plan for stockpiling of replacements and materials. The items should be studied with respect to vulnerability and importance. Particular attention should be given to stockpiling vulnerable hard-to-get items in overhead pipe lines.
9. The question of floodlighting for critical parts of the plant should be examined.
10. Other arrangements for process and utilities peculiar to the plant should be studied. . . .

c. *Phase III*

Procedures in event of declaration of war or enemy attack.

1. Accelerate Phases I and II.
2. Prepare to construct: auxiliary fire water system; protection for equipment and tanks; and small area employee shelters.

To assure effective functioning of the Plan, definite responsibilities have been assigned within the Company.

a. The Production Department, Central Staff, is charged with the overall planning and supervision of the Company Defense Security Plan.
b. The Industrial Relations Department, Central Staff, coordinates all aspects of the Plan affecting personnel.
c. The Operating Divisions are charged with the planning and supervision of the Defense Security Plan of plants of their respective Divisions.
d. Designated plants are responsible for the preparation of their respective plant plans.
e. Liaison will be maintained by the Production Department, Central Staff, with Federal, State, County, and City defense authorities.
f. The Department of the Army has designated the Chief of the Pittsburgh Procurement Office, Corps of Engineers, as the Armed Services Procurement Planning Office. Contacts will be made with that agency on such matters as facility clearances, visits to key facilities, and employee clearances on contracts of classified matter.

We hold no brief for our Plan as *the plan.* It fits our needs as we see them. . . . From company to company, you would probably find considerable difference from plan to plan in detail.

There is help available for you if you want to prepare such a plan in your company. The Business and Defense Services Administration, of the United States Department of Commerce, is actively working with industry . . . in considering the special problems of individual industries in planning for emergency and disaster.

There are three important considerations as we see the problem; first, to have an overall company plan covering your company as a whole, and each of your plants, and to incorporate in it as much planning and action as can be completed and *afforded* by the company before war comes; second, such a plan is the natural extension and broadening of existing safety and security programs to include the concept of disaster on a wide scale, rather than a localized, limited scale; and third, reduce your overall plan and the plan for each plant to writing, so there is no misunderstanding and as an assurance that you have covered all the essentials which you want to cover.

REFERENCES: Disaster Without Warning, Factory Management and Maintenance, July, 1953.
What The H-Bomb Means To Industry and You, Factory Management and Maintenance, May, 1954.
(Copies of these articles can be obtained from The Editor, Factory, 330 West 42nd Street, New York 36, N.Y.)

BIOLOGICAL WARFARE

(Continued from page 19)

We have come to believe that the use of the every available weapon by the Soviet is quite possible. This will certainly be true if they believe that such action will be to their advantage. We must believe this in the light of recent communist propaganda about our troops using BW in Korea. . . . The charges were, of course, a complete falsehood, but they may very well set the stage at a later date for the initiation by the communists of active—"BW" under the guise of "retaliation."

Soviet Capability for BW

Now as to our knowledge of the status of the Soviets in these matters. The Russians captured the Rheims Institute, where a German biological warfare laboratory was located, along with many technicians who worked there. . . . The Soviets have the scientists, facilities and materials necessary for producing a variety of BW agents in quantities sufficient for sustaining clandestine operations against selected targets—man, livestock, or crops, in the United States. . . . The Soviets were conducting research in the field of biological warfare as far back as the middle 1930's. . . .

Within the Soviet arsenal there is a massive potential. They have the capability of attacking the free world with atomic as well as hydrogen weapons, chemical, radiological and biological munitions, guided missiles and a tremendous ground, Naval and Air Force. . . .

We must be second to none in our preparation for offensive as well as defensive action. This posture of preparedness extends not only to nuclear and thermonuclear weapons, but to the fields of guided missles, chemical, biological, radiological and psychological warfare.

[General Creasy dwelt at some length on the safety precautions at the BW production development laboratory located at Pine Bluff Arsenal. Referring to his service at the Arsenal first as a Major during the construction period and later during the war as Chief of the Production Division, he said that he had recommended Pine Bluff as the site for this facility. He referred to its establishment as for the purpose of maintaining a status of operational ready standby in this field. "You have my complete reassurance," he said, "that into these laboratories have gone the most modern safety equipment and engineering aimed at providing the maximum safety."]

ATOMIC DEFENSE TRAINING

(Continued from page 12)

survey by listening to lectures on the subject than he could qualify as an expert in rifle marksmanship merely by reading a manual on the subject. The Radiological Laboratory and the radiologiacl field exercise areas are where the student's theoretical knowledge is put to a practical test, where the student learns by actually going through the operations as they would be performed in time of war.

All laboratory and field exercises involve the detection of nuclear radiation. Since this radiation cannot be detected by the physical senses, reliance for its detection and measurement must be placed solely upon specialized instrumnts. These are the RADIAC (Radioactivity Detection, Identification, and Computation) instruments. They are as basic a tool to the Radiological Defense technician as is the stethoscope to the diagnostician. An understanding of the operation and capabilities as well as the limitations of these instruments is essential even to the basic radiological monitor.

In order to furnish the student with the opportunity to perform applicatory exercises and to obtain the necessary practice in handling instruments, the School established its Radiological Laboratory in 1947. At that time, service-type radiac instruments were non-existent and commercial type instruments were used. These were gradually replaced as the military establishment adopted the design of particular instruments and designated them as standard issue.

At the present time the laboratory is staffed by five officer and four scientific and professional enlisted instructors, and with three qualified civilian electronic technicians to perform the maintenance and repair necessary to keep the instruments operative. The laboratory has sufficient facilities and equipment to permit the conduct of an exercise involving seventy-five of one type of instrument, and to handle and maximum student load of 250 if different instruments are used. In order to obtain the close supervision afforded by a lower student-instructor ratio, every effort is made to limit the size of the classes to fifty.

The laboratory subcourse consists of a series of practical exercises based on the use and operation of specific instruments or on certain operations in which the use of instruments is involved. At the beginning of the course the student is issued a bound volume of practical exercise pamphlets giving the theory involved, as well as a detailed description of each exercise to be performed later in the course. Each completed exercise is turned in for grading and then returned for the student's retention. Many former students have since reported that these bound volumes have proved to be invaluable aids in the subsequent training of their units.

Health Regulations Enforced

The handling of radioactive materials requires strict adherence to health physics procedures laid down by the AEC for peacetime conditions. The Health Physics Section is responsible for familiarization of the student with these procedures, enforcing radiological safety regulations, issuing film badges and pocket dosimeters, processing film badges, and recording radiation dosages.

In all phases of the practical work emphasis is placed upon field application. The program of instruction for each course determines which of the laboratory exercises will be performed. All groups participate in the exercises on Personal Dosage Devices, Calibration of Ionization Chamber Survey Meters, Calibration of Geiger Mueller Survey Meters, Calibration of Scintillation Survey Meters, Shielding Properties of Materials, Field and Organizational Maintenance, Decontamination, and Area Survey.

Survey exercises are conducted over terrain on which a large number of radioactive sources have been placed. The class is divided into two sections, one of which operates the plotting room, while the other is subdivided into survey teams consisting of an instrument monitor, a radio operator, and a recorder. Each survey team systematically covers its assigned area, reporting radiation intensities and map coordinates by radio exactly as done at the Nevada Proving Grounds. The plotting room plots this information on a master radiological situation map. Personnel are rotated so that each student engages in each type of work.

In addition to the above exercises the more advanced and specialized courses also include Scalar Counting Techniques, Calibration of Film Badges, Determination of Beta and Gamma energies, Alternate Uses of Field Survey Type Instruments, and Determination of Unknown Isotopes, jobs the Staff Chemical Officer at Army and Theater level may likely be called upon to supervise.

The goal of the laboratory exercises as well as of the classroom instruction is to give to military personnel, and especially the Chemical officer and non-commissioned officer, the knowledge and the practice necessary to enable them to carry out efficiently any duties or assignments they are likely to receive in the atomic field. For the Chemical Corps officer the six-week Atomic Defense Officer Course or its equivalent in the Advanced Course provides background necessary to guide him in the additional study needed to make him competent in this field.

EMERGENCY WATER SUPPLY TO TOWN

ARMY CHEMICAL CENTER, MD., July 22, 1954. When faucets went dry in Bel Air, Md., last week, the Chemical Center sent a convoy of six 400-gallon tank trucks with filled water to be dispensed to the townspeople.

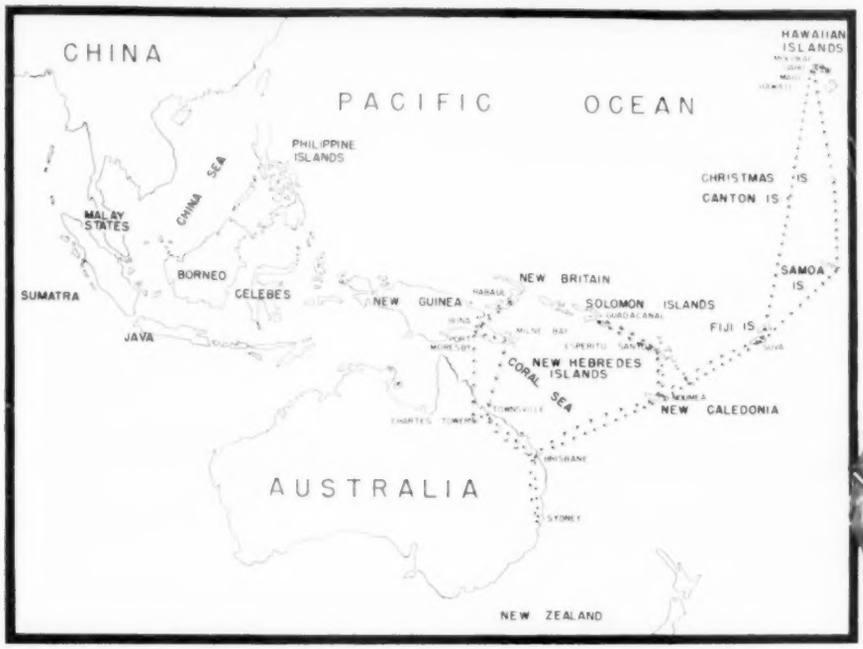
After an urgent call from Mayor John N. Wilkenson, Jr., and with the approval of Second Army Headquarters, Col. F. W. Gerhard, Post Commander, ordered the trucks to Bel Air, ten miles distant, the water delivery to continue until the emergency is alleviated.

Major E. E. Tiemann, the Army Chemical Center's assistant for facilities and services, is in charge of the water-hauling operation.



U.S. Army Photo

Mayor John N. Wilkenson, Jr., of Bel Air, Md., (on truck left), looks on approvingly as townspeople receive water from Army Chemical Center trucks.





FORTY-FIVE DAYS UNDER THE SOUTHERN CROSS

By Colonel Robert D. McLeod, Jr., Cml. C.
Historical Office
Office Chief of the Chemical Corps
Army Chemical Center, Maryland

Colonel McLeod was graduated from the U. S. Naval Academy in 1924 and in July of that year he was commissioned in the Chemical Warfare Service. His first duty was with the 1st Gas Regiment at Edgewood Arsenal, Maryland. Later as Chief of the Munitions Development Division, Edgewood Arsenal, he had a prominent part in the development of the 4.2-inch chemical mortar and in the manufacturing process for clothing impregnite.

After the trip to the South Pacific, which he tells about in this article, he selected the island of San Jose, Republic of Panama, as a jungle proving ground and remained there for a year as technical director of the project.

Colonel McLeod has an M.S. degree in chemical engineering from the M.I.T. He is a graduate of a number of service schools including the Industrial College. He has been awarded the Legion of Merit.

In the Spring of 1943 the Japanese invasion of the South Pacific area had been brought to a halt and the Allied counter attack was under way. Colonel (later Brig. Gen.) E. Montgomery, the Air Force chemical officer, became concerned over conditions which might develop in the Pacific theater if chemical warfare were used by the Japanese in an effort to regain the initiative. So that he might have a clear picture of the situation, Colonel Montgomery decided to send an officer to that theater to make a survey. At that time I was the chemical officer of the Fourth Air Force, with Headquarters at San Francisco, California. Colonel Montgomery wrote to Major General William E. Kepner, Commanding General of the Fourth Air Force, and requested that I be made available for that purpose. General Kepner agreed to release me and I was ordered to Washington for instructions.

On Sunday, June 20, 1943, a conference was held with the Air Chemical Officer, at which time verbal instructions were given. I was to make a survey of the Pacific Theater of Operations to determine the degree of preparedness of Air Force units in that area for defensive and offensive chemical warfare, the status of personnel and supplies, the suitability and condition of supplies and ammunition in the area, and special features of weather, vegetation and terrain peculiar to those regions which would affect the use of chemicals. Col. Montgomery had obtained the approval of the Chief Chemical Warfare Service, Maj. Gen. William N. Porter, for me to make this trip. Gen. Porter decided that it would be desirable for me to observe all CWS activities in the area rather than to limit my scope to Air Force installations. I was therefore told to contact Major John D. Reagh in the Office of the Chief, Chemical Warfare Service, Colonel Adrain St. John, the Army Ground Force chemical officer, and Lt. Col. H. Paget of the British Army. Col. Paget had just arrived from the Southwest Pacific Area and was kind enough to give me a lot of good advice concerning the area to be covered and told me to be sure to see a British medical officer, Major F. S. Gorrill, who was making some field tests near Cairnes, Australia.

On Thursday, June 24, I returned by commercial airplane to San Francisco, and one week later left Hamilton Field for Hawaii. The trip was made in a converted B-24

bomber operated by the Air Transport Command which had seats placed in a compartment built in the bomb bay. A number of extra tanks of gasoline were in the rear part of the compartment and as a result there was no smoking allowed in the plane. We arrived in Hawaii next morning and had breakfast at the airfield. After breakfast the flight was resumed. We reached Canton Island that afternoon. This island is a little sandspit in the form of a circle with an inner lagoon which is very beautiful. However, the island is practically devoid of vegetation. I believe there was only one tree on the island, of which everyone there was quite proud. The commanding officer of Canton Island was Colonel Lothar Smith of the Air Force. I had known him before as commanding officer of Hammer Field at Fresno, California.

Stop at Canton Island

There had not been much fighting at Canton Island up to that time. The Japs had made one or two air raids and a Japanese submarine had torpedoed a ship which was beached near the entrance to the lagoon. The sinking of the ship may have been a loss to the nation but to the garrison of Canton Island it was a bonanza. They had salvaged all sorts of creature comforts off the ship, the upper parts of which were still well above water.

The next morning we left Canton Island and flew to the Fiji Islands. By crossing the date line we lost a day so we arrived at the Fiji Islands the afternoon of July 4th, 1943. In celebration of the 4th of July some of the local officers produced some Australian beer which they thought was a great treat. Just having left the U.S.A., and not having had time to develop a thirst, I thought it tasted like prohibition home brew. However, I did appreciate their hospitality. Visiting officers' quarters were located in a thatched hut which was very picturesque and quite comfortable. I met Lt. Col. Thompson, the executive officer of the 2nd Island Command of the 13th Air Force, and Captain Sommerfrucht, the chemical officer. Captain Sommerfrucht stated that his bleach was going bad. He suggested that the Chemical Warfare Service be given the responsibility for the supply of all bleach used for all purposes so that a moderate turnover for sanitary purposes would use up the supply of bleach before it deteriorated. The captain also told me that the protective ointment had spoiled and had damaged some gas masks in the carriers in which the ointment was being carried. It was apparent that the Chemical Section needed more storage space as the warehouses were of the most flimsy construction and badly overcrowded. Captain Sommerfrucht stated that the 96th Chemical Composite Company was in Sura but there was insufficient time to visit it.

I made a trip around the island and found the Fiji Islands had not been developed to the same extent as Hawaii. However, the climate there was delightful, comparable to the Hawaiian Islands. After a pleasant night in the Fijis our plane left for New Caledonia. It stopped at Plaines des Gaiacs just long enough for lunch and then left for Brisbane, Australia, where we arrived about 3 p.m. on July the 5th.

Visits Made in Australia

In Brisbane I reported to Colonel William A. Copthorne, the chemical officer of the U. S. Army Forces in the Far East. Colonel Copthorne informed me that there had been a meeting of chemical officers from Australia, New Guinea and New Caledonia just a few days before and was sorry that I had missed it. On July the 6th we had a conference with most of the C.W.S. officers in Brisbane. A call was also made on Brigadier General Donald Wilson, Chief of Staff of the Fifth Air Force.

Weather in Brisbane was mild, the Australians were quite friendly and the living accommodations I had were comfortable. I was billetted in the Lennons Hotel. The dining room would serve beefsteak three times a day if one desired it. Meat rationing was very strict in the United States at that time and beefsteak had become almost a rarity. Needless to say I caught up on my steak ration.

On Wednesday, July 7th, I drove out to the headquarters of the Sixth Army for a conference with Colonel Carl L. Marriott, the chemical officer. The Sixth Army was camped about twenty miles from Brisbane. Colonel Marriott was enthusiastic about the Sixth Army. Unfortunately he became sick some months later and had to be returned to the United States.

The next day we called on Major W. C. Weber, the chemical officer of the Fifth Air Force and visited the Chemical Warfare School which was being conducted in that area. That same afternoon I flew to Sydney, arriving about 4 p.m. Sydney is considerably larger and more modern than Brisbane. However, they were then having their winter and as I was dressed in summer apparel I picked up a bad cold which stayed with me until I left Australia. Lt. Col. John C. Morcock was the Chemical Officer for the Service of Supply. The 62nd Chemical Depot Company was also at Sydney, commanded by Captain H. T. Ayres. They were doing a fine job of waterproofing the training mask. It had been found that the troops in the South Pacific Area would not carry the service mask as it was too heavy. However, the little training mask was so much lighter than the service mask that they would carry it. Since the training mask gave a certain amount of protection it was decided it was better for the troops to have a mask which would give some protection and which they would carry than to issue a mask that would give complete protection but would probably be thrown away.

The following morning I returned to Brisbane from Sydney and the next day I left for Townsville and Charters Towers. Here I was met by Major V. A. Willson and Major M. A. Peerenboom. The flight from Brisbane to Port Morsby was made in Australian planes. On these planes there was a good deal of communistic literature, also articles in praise of Russia. Apparently the Reds were busy working their way into Australia at that early date. At Townsville I stayed at Queen's Hotel, a fine old structure which reminded me very much of a hotel in the early days of our Wild West. I had a special suite of rooms in which Mrs. Eleanor Roosevelt had stayed a short while before. The interior was as dark as a funeral parlor and furnished with dark blue overstuffed furniture. There was a large bed with mosquito netting all around which was like a canopy for an old time monarch. The bath tub was up on high stilts. If a person ever slipped getting out of that bath tub he would probably break his neck.

The next day I called on Colonel Victor E. Bertandias, Commanding Officer of the Air Depot, at Townsville. Colonel Bertandias was anxious to have some power-driven decontaminating apparatus for fire fighting equipment. He also wanted a group chemical section composed of one officer and seven men.

The terrain and vegetation around Townsville was quite similar to that of Maryland, except that the trees were small gum trees, much heavier than Maryland trees of the same size. I tried to locate Major Gorrill but was told that he had returned to England for a short time.

On July 13th I drove from Townsville to Charters Towers. There I visited Lt. W. L. Behrens, commanding the 894th Chemical Air Operations Company, and Captain C. N. McCarthy, commanding the 760th Chemical

Depot Company, Avn. A toxic gas yard and field filling plant were located here. The air operations company was doing a fine job of decontaminating and tightening up a large shipment of leaky mustard gas bombs. These bombs had arrived in Australia in poor condition and it was necessary for the company to take field action to repair them and put them in serviceable condition. The field filling plant worked well except the hoses did not stand up well. The FS smoke pump broke at the joint.

Proceeds to New Guinea

I left Townsville for Port Moresby, New Guinea, on July 14th, and arrived about 10:00 a.m. There I checked in at the Advanced Echelon of the Fifth Air Force, met Colonel Cooper, the chief of staff, and Major T. J. Cummins, the chemical officer.

Major Cummins and I were invited to spend the night with the 7th Australian Brigade. The men of this brigade had a distinguished record in World War II. They arrived in England shortly after Dunkirk and were sent to Egypt where they participated in the Libyan Campaign, and were in Tobruk during the siege. After Japan entered the war they returned to Australia and had fought the battle of Milne Bay and the battle of Wau. At the time of my visit they were in a rest camp above Port Moresby. I was told that these troops had had more battle experience than any other troops on the island. The terrain in the vicinity of their camp was said to have areas which were typical of almost all types of terrain in New Guinea.

The trip to the camp was very interesting. The road was rough but the scenery was beautiful. We travelled along the banks of the Laloki River and observed some very spectacular waterfalls. The camp of the Australians was on high ground above the river. We reported to Brigadier John Field who introduced us to the officers of his command. After dinner there was a general discussion which lasted until 10:00 p.m. during which time many of the more interesting incidents in the last campaigns of the 7th Brigade were brought out. Brigadier Field gave me a copy of a report he had prepared on the Milne Bay campaign.

That night I slept in a tent on a low Australian cot which barely cleared the ground. However I was tired and slept well. The next morning I looked around and found a lizard had been in bed with me and had been completely crushed as I thrashed around during the night. That day an officer was detailed to show us sample bits of terrain, examples of Japanese dugouts, and samples and method of operation of typical Japanese and Australian weapons. We also saw various training activities of the troops of the brigade, including crossings of the very swift river and the various methods of making bridges for getting across the stream. After lunch we returned to Port Moresby.

I left Port Moresby for Dobodura on July 17th, 1943. The flight from Port Moresby to Dobodura was across the beautiful but rugged Stanley Owen Mountain Range. It took us but an hour to make a trip that would take a hardened infantry soldier from 18 to 28 days to make on foot. The year before a Japanese army had marched against Port Moresby following the Kokoda Trail across the mountains. They fought their way over sharp ridges and deep gorges until they were within 32 miles of the port. There they were pinned down by the Australians while their supply lines were blasted from the air. Native bearers who had been impressed by Japanese used the air raids as an opportunity to disappear into the jungle often carrying the supplies with them. Pounded from the air, short of food and ammunition, and vigorously attacked by the Australians and American infantry, the Japanese started one of the most disastrous retreats in history. Of the strong Japanese Army which had started out for Port Moresby, only a handful of half-starved and fever-stricken fugitives returned to their base at Buna. It is doubtful if a war was ever fought under worse conditions than the campaign in New Guinea (Papua).

At Dobodura I was met by Capt. Dodge, who took us to Ora Bay, Buna and Buna Mission. Signs of the recent fighting were in evidence everywhere. Wrecked Japanese planes, dugouts, shell-shattered trees were all around us. On a hill above Ora Bay was a sign "City Limits of Los Angeles," evidently placed there by some Californian. In Dobodura I met Colonel Fred Smith, Commanding Officer of 1st Air Task Force. Colonel Smith arranged for me to go on a combat mission the following day with the 13th Attack Squadron. Early the next morning I reported to the briefing room which was in a shack on stilts in the middle of a swamp. It was explained that our target was a small Japanese steamer which was being used to supply Japanese garrisons from their main base at Rabaul, New Britain. This steamer had been sighted by one of our reconnaissance planes and fired on by machine gun fire, but since the plane carried no bombs they had been unable to sink the ship. We were warned to be on the alert for Japanese Zeros from Gasmata or Rabaul.

Accompanies Bombing Mission

Our flight consisted of three B-25 medium bombers which carried 500-lb. HE bombs and were heavily armed with machine guns. We took off early in the morning and reached the coast of New Britain not far from Gasmata. From there we followed the shore line looking for the enemy ship. We flew in a V formation very close to the water to reduce the chances of being picked up by radar. No Zero could attack us from below and if one dived at us he had a good chance of going on into the water. If he approached head on he would run into terrific machine gun fire and if he attacked from the rear we would still put up a good fight. I sat on a ledge behind the pilot, 1st Lt. Bertsch and co-pilot, 2nd Lt. Taylor, in the lead plane and had a very good view of everything that went on. Shortly after we started our run up the coast the pilot told me that the firing circuits had gone dead and that we would have to return to our base. However, an open circuit breaker was located by the crew chief, Sgt. Wittick; it was closed and everything was checked so we continued on our mission. Without any warning the pilot started to fire his machine guns. I looked down and saw a Japanese barge beneath us. Its crew was diving over the side. A short time later we fired on another barge. Then a large canoe filled with natives came in view. We did not fire on it but instead gave our wings a friendly dip. I suspect that the pilot wanted to stay on good terms with the natives so that we wouldn't end up in the stew pot in case we were forced down. We located our target, the Japanese ship, near Cape Kwoi about 80 miles from Rabaul. She was drawn up close to a high bluff. We could not attack her by skip bombing as we would have run into the bank, so the flight leader swung around and flew down a little valley toward the ship. It was an awkward angle and on our first pass the bombs fell beyond the ship. We made another circle and on the second pass scored several direct hits. By the time the plane was again in a position where I could look at our target she had disappeared beneath the water. Our mission accomplished, we headed for home by the most direct route.

(To Be Continued in Next Issue)

BASIC TRAINING FOR CHEMICAL CORPS EMPLOYEES

By S. J. Tobin

Training Specialist Deseret Chemical Depot.

The forty (40) hour course described herein is a program of basic instruction compiled to meet the needs of Deseret Chemical Depot employees for general information regarding Chemical Corps activities and functions, items, materiel, and equipment; and for a frame of reference concerning the Depot and its position within the Chemical Corps and Military Defense Organization. Such information is usually unavailable to many employees. This lack of knowledge is often a cause of poor judgment, faulty handling of records and materials, and misunderstanding of orders and directives. Too often, clerical and other office personnel have little or no conception of the actual use of items their records and files concern. Further, few employees know the mission of their unit, the chain of command of their organization or installation, and the ultimate use of items they handle on the job. It is, therefore, a training responsibility to provide that basic information necessary for optimum orientation of employees. Proper orientation and understanding are vital, for it has been clearly illustrated by Industry that informed employees, those who know the what, the where, the when, the who, the why, and the how of things, are the ones from whom the best results are obtained. This applies to management as well as to supervisory personnel. It is anticipated that this training will augment other programs in effect on the Depot by enlarging the scope of information available to employees, thus providing a partial solution to the problem.

A subject outline, partial schedule, and references for the course are the following:

SUBJECT OUTLINE

Basic Training Course

Title	*Hours*
1. Orientation and Introduction	1
2. Organization for Military Defense, Department of the Army, Chemical Corps, Chemical Corps Materiel Command (General)	2
3. Deseret Chemical Depot, Organization and Functions	1
4. Supply Operations, Organization and Functions	1
5. Storage Division, Organization and Functions	2
6. Maintenance Division, Organization and Functions	2
7. Stock Control Division, Organization and Functions	1
8. Inspection Office, Organization and Functions	1
9. Chemical Warfare Items, Munitions, Materiel, and Equipment	2
10. Toxics	6
11. Smoke	2
12. Incendiaries	3
13. Explosives	6
14. Dunnage	5
15. Salvage	1
16. Safety	1
17. Care and Use of the Gas Mask	1
18. First Aid	2
	40

SCHEDULE

Basic Training Course

Subject	*References, Training Aids*
Orientation & Introduction (1 hour)	Registration Blanks Films: M 1144, "Ideas Unlimited" M 1258, "Budgeting the Work Effort" M 1259, "Developing Cooperation" M 1260, "Building Morale" M 1261, "Creating Job Interest"
Organization for Military Defense Department of the Army Chemical Corps Chemical Corps Materiel Command (General). (2 hours)	Organization Charts: Military Defense Department of the Army Chemical Corps Chemical Corps Materiel Command SR 10-350-1, par 1-25 SR 350-15-1, par 5 & 6 ST 3-171, "Organization of the Chemical Corps" FM 3-15, "Supply and Field Service"
Deseret Chemical Depot, Organization and Functions (1 hour).	Organization Chart: Deseret Chemical Depot SR 780-11-1, par 10-16
Supply Operations, Organization and Functions (1 hour)	Organization Chart: Supply Operations SR 780-5-1, par 70-87 Films: M 10-1611, "Depot Organization and Operation" TF 3-1341, "Storage and Handling"
Storage Division, Organization and Functions (2 hours)	Organization Chart: Storage Division SOP's and Functional Statements: Storage Division, Specialist Staff, Administrative Office, Storekeeping Branch, Care and Preservation Branch, Labor and Equipment Branch. SR 780-5-1, par 82-87
Maintenance Division, Organization and Functions (2 hours).	Organization Chart: Maintenance Division SOP's and Functional Statements: Maintenance Division, Planning and Control Office, Administrative Office, Repair Branch, Ammunition Renovation Branch, Demilitarization Branch, Shop Supply Branch. SR 780-5-1, par 87-92
Stock Control Division, Organization and Functions (1 hour)	Organization Chart: Stock Control Division SOP's and Functional Statements: Stock Control Division, Administrative Office SR 780-5-1, par 77-82 Films: M 1112, "Stock Control at War" FG 10-18, "Operation Streamline, Stock Accounting"
Inspection Office, Organization and Functions (1 hour)	Organization Chart: Inspection Office SOP's and Functional Statements: Inspection Office, Administrative Office, Field Inspection Branch, Laboratory Branch SR 780-5-1, par 100 Film: M 8088, "Methods of Inspection and Quality Control of Manufactured Items"

Chemical Warfare Items, Munition, Materiel, and Equipment (2 hours).	FM 3-5, "Characteristics and Employment of Ground Chemical Munitions" FM 3-6, "Employment and Characteristics of Air Chemical Munitions" TM 3-300, "Miscellaneous Chemical Munitions" Film: FS 3-32, "Chemical Munitions"
Toxics (6 hours)	FM 3-5, "Characteristics and Employment of Ground Chemical Munitions" FM 3-6, "Employment and Characteristics of Air Chemical Munitions" TM 3-215, "Military Chemistry and Chemical Agents" GTA 3-1, "Defense Against CBR" M 3-2016, "Individual Protection Against Chemical Attack" M 3-1407, "Decontamination Procedure, Basic Techniques" M 3-667, "Decontamination Procedures, Personnel and Areas" M 3-687, "Decontamination Procedures, Equipment" M 3-689, "Defense Against Chemical Warfare" M 3-1535, "Effects of Weather on Travel of Gas and Smoke Cloud"
Smoke (2 hours)	FM 3-5, "Characteristics and Employment of Ground Chemical Munitions" FM 3-6, "Employment and Characteristics of Air Chemical Munitions" Films: M 3-1496, "Technique of Using Smoke" FB 214, "Combat Smoke Operations" M 3-1719, "Combat Smoke Operations"
Incendiaries (3 hours)	FM 3-5, "Characteristics and Employment of Ground Chemical Munitions" FM 3-6, "Employment and Characteritics of Air Chemical Munitions" Films: M 3-957, "Defense Against Incendiaries" M 3-1561, "Incendiary Bombs, Description and Functioning" M 3-1562, "Incendiary Bombs, General Principles"
Explosives (6 hours)	FM 5-25, "Explosives and Demolitions" FM 3-5, "Characteristics and Employment of Ground Chemical Munitions" FM 3-6, "Employment and Characteristics of Air Chemical Munitions" GTA 5-5, "Explosives and Demolitions" Films: FB 198, "Explosives in Combat" M 5-1301, "Fundamentals of Demolitions" M 5-1377, "Explosives and Demolitions, Bangalore Torpedo" M 5-954, "Enemy Booby Traps" M 25-394, "Detection of Booby Traps" M 5-1481, "Mine Fields" M 5-1528, "Anti Personnel Mines, Employment and Installation" M 5-2039, "Passage of Mine Fields" M 9-618, "Unexploded Bombs" M 9-1609, "Disposal of Unusable Ammunition" M 7-1362, "Anti-Tank Rifle Grenade"
Care and Use of the Gas Mask (1 hour)	Gas Masks Film: M 3-1339, "Adjustment of the Lightweight Gas Mask"
Safety (1 hour)	Films: M 1093, "For Safety's Sake" M 7857, "A Closed Book"
Dunnage (5 hours)	SOP's Storage Division Films: M 9-1358, "Preparation of Materiel for Overseas Shipment, Part I" M 9-1359, "Preparation of Materiel for Overseas Shipment, Part II" M 9-1374, "Preparation of Materiel for Overseas Shipment, Part III" M 10-2095, "Operator's Care and Maintenance of Materials Handling Equipment" M 9-2026, "Care and Use of Hand Tools, Part I" M 9-2027, "Care and Use of Hand Tools, Part II" M 9-2028, "Care and Use of Hand Tools, Part III" M 9-2029, "Care and Use of Hand Tools, Part IV" M 9-2030, "Care and Use of Hand Tools, Part V" M 9-2031, "Care and Use of Hand Tools, Part VI"
Salvage (1 hour)	Films: M 1073, "Attack on Hidden Waste" M 1199, "Let's Look at Salvage" M 1175, "Reclamation and Salvage"
First Aid (2 hours)	GTA 3-1, "Defense Against CBR" Films: M 8-1180, "First Aid for Chemical Casualties"

To summarize briefly on conducting the course, registration of students is completed, the scope and purpose of the training is stated, and appropriate films are shown during Orientation and Introduction. Then, the position of the Depot within the Materiel Command, The Chemical Corps, Department of the Army, and the Military Defense Organization is given to impart a general knowledge of the nature and functions of higher echelons of command. Next, the mission, organization and functions of Deseret Chemical Depot are presented, stressing Supply Operations and subordinate divisions and branches. The main emphasis is on Chemical Corps Items, Munitions, Material, and Equipment. Films, charts and actual items are shown and discussions, pertinent to Depot operations are included. Guided tours of work areas are conducted to afford personnel first hand experience and knowledge of Toxics, Smoke, Incendiaries, and Explosives. Tests on this section of the training are given to emphasize aspects deemed vital to proper handling of these items. Instruction on Dunnage and Salvage is also given to provide a more complete understanding of factors involved in storing, processing, and shipping items handled by the Depot. Material on Use of the Gas Mask, Safety and First Aid presented is coordinated with Depot Safety and First Aid Programs.

A similar course, based upon local conditions, may be of value to other Chemical Corps Installations.

CHEMICAL CORPS BRIEFS

(Continued from page 4)

PHOSPHATE WORKS

General Creasy further stated that the project is conducted by a team composed of both Chemical Corps personnel under the command of Lt. Col. Harvey E. Sheppard and TVA personnel under the direction of Mr. Charles H. Young, Manager of Chemical Engineering. Nerve gas itself is not manufactured at the Muscle Shoals Project and General Creasy stated that the chemical products being manufactured at the Muscle Shoals plant are relatively non-toxic and do not present any hazard to the nearby communities. All necessary safety precautions, it is stated, are used to protect the operating personnel.



MRS. EDNA SUMMERFIELD

Mrs. Edna Summerfield, Research and Development Division, Office, Chief Chemical Office, being presented the Certificate of Achievement by Major General William M. Creasy, Chief Chemical Officer. Mrs. Summerfield recently retired after 36 years of Government service.

NEW YORK SUGGESTION AWARDS

Mr. Herman Wiener, of the Engineering Division, New York Chemical Procurement District, 180 Varick St., New York City, principal purchasing office of U. S. Army Chemical Corps, received the top cash award of $600.00, in the Employee Suggestion Program. The award was presented to Mr. Wiener for a suggestion which enabled the Chemical Corps to save approximately $450,000.00. He recommended that a metallic overwrap be used in 5,000,000 obsolete metal cans, thereby saving the replacement cost of these cans. In addition to the cash award, the Department of the Army Suggestion Award Certificate was presented to Mr. Wiener.

Mr. John J. Shaughnessy, Packaging Specialist in the Planning Division, earned a cash award of $275.00 for his suggestion that all material and supplies shipped overseas be clearly marked, "Made in the United States of America."

ROA CHAPTER AT ACC

ARMY CHEMICAL CENTER, MD.—Newly elected officers of the first Army Chemical Center, chapter of the Reserve Officers Association met recently to formulate plans for the future. In the picture below are: Col. Garland M. White, center, president of the chapter, Lt. Col. Karl E. Erickson, right, vice president and Mr. Thomas Smith, a first lieutenant in the Reserve, secretary-treasurer. The election followed a luncheon at the Gunpowder Officers Mess where Col. White outlined principles of ROA and aims for the future.



TAKES HARVARD COURSE



Mr. Albert Humphrey, chemical engineer assigned to the office of the Chief Chemical Officer, has been granted leave of absence to take a special 16-months course in business management and administration provided by Harvard University for selected young men of promise from government and industry. A native of Kansas City, Mr. Humphrey is a graduate of the Kansas City Teachers' College, and has a Master's Degree from Massachusetts Institute of Technology.

MISS FLORENCE EDYTHE CONNERY

Miss Florence Edythe Connery, retiring after 35 years service to the Army including 34 years in the offices of the Chemical Corps in the New York area, receives the Army award for outstanding performance of duty presented by Colonel Walter A. Guild, Chemical officer, Hqrs., First Army, Governor's Island, N. Y.

U.S. Army Photo



CIVIL DEFENSE CBR COURSE

FORT McCLELLAN, ALA. — Twenty-two Civil Defense officials, coming from as far as Juneau, Alaska, and as near as Tuscaloosa, Alabama, attended a Civil Defense CBR Orientation Course at the Army's Chemical Corps School here during the week of June 7-12.

A special course conducted by agreement of the Federal Civil Defense Administration, Department of Defense, and the Chief Chemical Officer, this orientation was designed to train selected Civil Defense personnel from the Federal and State Governments, political subdivisions, and industry in defense against chemical attack.

Below is a picture of the class.



Third Row: Eugene L. Lehr, Washington, D.C.; Frank J. McFarland, Washington, D.C.; Eldon A. Means, Wichita, Kansas; Max D. Moody, Chamblee, Ga.; Everett J. I. Paulson, Minneapolis, Minn.; James G. Richardson, Juneau, Alaska; Durwood J. Smith, Burlington, Vt.; Robert H. Byers, Atlanta, Ga. Second Row: Mullen O. Coover, Morgantown, W.Va.; Harold F. Eppson, Laramie, Wyo.; Gerald W. Ferguson, Washington, D.C.; Earl O. Fisk, Concord, N.H.; H. Kenneth Gayer, Washington, D.C.; James E. Holland, Washington, D.C.; Edward LaFleur, Bismarck, North Dakota. Front Row: Thomas H. Alphin, Washington, D.C.; Louis Block, Washington, D.C.; Paul D. Bryan, Tuscaloosa, Ala.; James H. Defandorf, Washington, D.C.; Col. Wm. W. Campbell, Actg. Comdt.; Lt. Col. R. B. Caldwell, Cls. Dir.; Clem M. White, Washington, D.C.; Gordon H. Cameron, Trenton, N.J.; Lawrence R. Collins, New Orleans, La.

FOREIGN OFFICERS GRADUATED

Five officers from foreign armies are shown in the picture being congratulated upon their graduation, June 25, from the Eight Advanced Officers' Class, The Chemical Corps School, Fort McClellan, Alabama, by Brigadier General Charles E. Loucks, Deputy Chief Chemical Officer. From the left: General Loucks; Colonel Antonio S. Castro, Argentine Army; Lieutenant Colonel Manoel L. Dos Santos, Brazilian Army; Major Prasarn Prasassarakitch, Thailand Army; Major Walter Meyer, Brazilian Army, and Captain Mohsen Sabet, Egyptian Army.



OFFICERS DECORATED

A ceremony was held at Ft. McClellan, Ala., during June in which two officers and two non-commissioned officers of the Chemical Corps received decorations for meritorious service in combat operations in Korea.

Captain James N. Elliott, son of Colonel Lowell A. Elliott, retired, of Baltimore, Md., received the Bronze Star Medal in recognition of outstanding service as commander of Company C, 2d Chemical Mortar Battalion and as Battalion Operations Officer.

First Lieutenant Donald Cheesebrough of Stonington, Conn., was decorated with a Bronze Star Medal for meritorious service as platoon leader in a Smoke Generator Company in providing smoke screening of vital areas.

Sergeant Calvin Lindsey, 367th Chemical Depot Company, received the Bronze Star Medal for meritorious service as a squad leader with the 45th Military Police Company, 45th Infantry Division.

Corporal Harold R. Kelly of Fairport Harbor, Ohio, was awarded the Army Commendation Ribbon with Metal Pendant for outstanding service as squad leader with Company A, 461st Infantry Battalion. Corporal Kelly is now assigned to the 62nd Chemical Smoke Generator Company.

TO INDUSTRIAL COLLEGE



ARMY CHEMICAL CENTER, MD. Edgar A. Crumb, executive director of the Chemical Corps Research and Engineering Command, Army Chemical Center, was selected by the Department of Defense as the Army's civilian representative to attend the 1954-1955 session of the Industrial College of the Armed Forces.

The Industrial College located at Fort McNair, Washington, D. C. is on the highest level of education in the military system, operating under the direct jurisdiction of the Joint Chiefs of Staff.

Mr. Crum, one of four civilians selected, was born in Northampton County, Va., and attended the New Mexico School of Mines. During World War II, he saw active duty as a Marine Corps officer and is presently a lieutenant colonel in the U. S. Army Reserve.

Mr. Crumb is a charter member of the Armed Forces Chemical Association.

PINE BLUFF YOUTH CENTER

A committee to foster and oversee youth activities at Pine Bluff Arsenal, composed of representatives of various patriotic, social and educational organizations in the Pine Bluff Arsenal area has been established there. Lieut. Col. Timothy C. Williams, Deputy Commander of the Arsenal, organized the activity which includes a building known as the Youth Center providing facilities for games, dances and other recreational activities.

R.O.T.C. TRAINING

All phases of Army life kept 378 cadets busy for six weeks at the 1954 Chemical Corps ROTC Camp at Ft. McClellan, Alabama.

The cadets, most of them trained in scientific subjects, came from 62 colleges and universities in all parts of the nation. Commissions were received by 138 and the others expect commissions after their final year of college. The largest groups of students came from St. Peter's College (96), Wake Forest (68) and Massachusetts Institute of Technology (26).

GROUP AND SUSTAINING MEMBERS

OF THE ARMED FORCES CHEMICAL ASSOCIATION

Abbott Laboratories, North Chicago, Ill.
Aerial Products, Inc., Elkton, Md.
Air Reduction Company, Inc., New York, N. Y.
Allen Products Corp., Nashville, Tenn.
Allied Chemical & Dye Corporation, New York, N. Y.
American Aniline Products, Inc., New York, N. Y.
American Cyanamid Company, New York, N. Y.
American Zinc, Lead & Smelting Co.
Armour & Company, Chicago, Ill.
Armstrong Cork Company, Lancaster, Pa.
Atlas Powder Company, Wilmington, Del.
Baker & Company, Inc., Newark, N. J.
Bastian-Morley Co., Inc., LaPorte, Indiana
Bechtel Corporation, San Francisco, Calif.
Bell & Gossett Company, Morton Grove, Ill.
Benjamin Reel Products, Inc., Cleveland, Ohio
Blaw-Knox Construction Company, Pittsburgh, Pa.
Blickman, S., Inc., Weehawken, N. J.
Bridgeport Brass Company, Bridgeport, Conn.
Brown Company, Berlin, N. H.
Buffalo Electro-Chemical Company, Inc., Buffalo, N. Y.
Casco Products Corporation, Bridgeport, Conn.
Celanese Corporation of America, New York, N. Y.
Central Foundry Company, The, Newark, N. J.
Chamberlain Corporation, Waterloo, Iowa
City Chemical Corp., New York, N. Y.
Columbia-Southern Chemical Corp., Pittsburgh, Penna.
Continental Can Co., Inc., Chicago, Ill.
Continental Oil Co., Ponca City, Okla.
Curtis Industries, Inc., Helene, Chicago, Ill.
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
Dunham, C. A., Co., Chicago, Ill.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Edo Corporation, New York, N. Y.
Eldon Manufacturing Company, Los Angeles, Calif.
Empire Stove Company, Belleville, Ill.
Endciott Johnson Corporation, Endicott, N. Y.
Evans Research & Development Corp., New York, N. Y.
Federal Laboratories, Inc., Saltsburg, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland. Ohio
Firestone Industrial Products Div., Fall River, Mass.
Fisher Price Toys, Inc., East Aurora, N. Y.
Fisher Scientific Co., New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Calif.
Foster Wheeler Corporation, New York, N. Y.
Fram Corporation, Providence, R. I.
Fraser & Johnston, San Francisco, Calif.
Gasket, Packing & Specialty Co., Inc., New York, N. Y.
General Aniline & Film Corporation, New York, N. Y.
General Tire & Rubber Company, The, Wabash, Ind.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Goodyear Tire & Rubber Company, Akron, Ohio
Gray Stamping & Manufacturing Co., Plano, Ill.
Gulf Oil Corporation, Pittsburgh, Pa.
Haertel, Walter, Company, Minneapolis, Minn.
Handy & Harman, New York, N. Y.
Harshaw Chemical Company, The, Cleveland, Ohio
Harvey Machine Co., Inc., Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Hesse-Eastern Corporation, Cambridge, Mass.
Heyden Chemical Corporation, New York, N. Y.
Hooker Electrochemical Company, Niagara Falls, N. Y.
Howell Company, The, St. Charles, Ill.
Hyman, Julius & Company, Denver, Colo.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Business Machines Corporation, Endicott, N. Y.
International Nickel Co., Inc., New York, N. Y.
International Salt Co., Inc., Scranton, Pa.
International Silver Company, Meriden, Conn.
Jefferson Chemical Company, Inc., New York, N. Y.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Kilgore, Inc., Westerville, Ohio
Koppers Company, Inc., Pittsburgh, Pa.
Kwikset Locks, Inc., Anaheim, Calif.
LaBelle Industries, Inc., Oconomowoc, Wisc.
Lambert Pharmacal Company, St. Louis, Mo.
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Mathieson Chemical Corporation, Baltimore, Md.
Merck & Company, Inc., Rahway, N. J.
Milwaukee Stamping Co., Milwaukee, Wisc.
Moe Light, Inc., Ft. Atkinson, Wisc.
Monarch Aluminum Mfg. Co., Cleveland, Ohio
Monsanto Chemical Company, St. Louis, Mo.
Mundet Cork Corporation, New York, N. Y.
National Fireworks Ordnance Corp., West Hanover, Mass.
Niagara Alkali Company, New York, N. Y.
Niagara Blower Co., New York, N. Y.
Nopco Chemical Co., Inc., Harrison, N. J.
Oldbury Electro-Chemical Co., Niagara Falls, N. Y.
Olin Industries, Inc., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Parsons, Ralph M., Company, The, Los Angeles, Calif.
Pemco Corporation, Baltimore, Md.
Penick, S. B., & Company, New York, N. Y.
Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.
Pfizer, Chas. & Company, Inc., Brooklyn, N. Y.
Philco Corporation, Philadelphia, Pa.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Rau Fastener Co., The, New York, N. Y.
Ric-wiL Company, Barberton, Ohio
Rohm & Haas Company, Philadelphia, Pa.
Rudy Manufacturing Co., Dowagiac, Mich.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Sherwin-Williams Company, The, Cleveland, Ohio
Shwayder Bros., Inc., Denver, Colo.
Standard Oil Company (Indiana), Chicago, Ill.
Standard Oil Development Co., New York, N. Y.
Stauffer Chemical Company, New York, N. Y.
Stewart Die Casting, Chicago, Ill.
Sun Oil Company, Philadelphia, Pa.
Tranter Manufacturing, Inc., Lansing, Michigan
Unexcelled Chemical Corp., Cranbury, N. J.
Union Carbide & Carbon Corp., New York, N. Y.
United Carr-Fastener Corp., Cambridge, Mass.
United States Rubber Company, New York, N. Y.
Universal Match Corp., Ferguson, Mo.
Vitro Corporation of America, New York, N.Y.
Vulcan Copper & Supply Co., The, Cincinnati, Ohio.
Wallace & Tiernan Products, Inc., Newark, N. J.
Westvaco Chemical Division, New York, N. Y.
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemical Corp., Wyandotte, Mich.
Zaremba Company, Buffalo, N. Y.
Zenith Plastics Company, Gardena, Calif.

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